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Abstract

Spurred on by increasing digitalization and the rise of technology companies such as Facebook, Airbnb or Uber, multi-sided platforms (MSPs) have become increasingly important in a wide range of industries in recent years. In general, MSPs represent an electronic marketplace in which two or more groups of actors interact, and the decisions of individual actors influence the decision-making behavior of the remaining actors. Due to their distributed nature and their interdependencies with institutions, markets, and technologies, MSPs depict unique, new socio-technical artifacts and therefore present researchers with an exciting and challenging research object.

Previous research on MSPs have predominantly taken a pro-innovative perspective and have accumulated a vast knowledge base on factors that promote the success of MSPs. However, the triumphant growth and success of MSPs, such as Airbnb or Uber, represent the exception rather than the rule. Most multi-sided platforms are struggling hard to stay viable and often lose this battle. Failure of an MSP can result in massive financial damage for companies, which is revealed, for example, by the \$4 billion collapse of General Electric's "Predix" platform. Existing technology diffusion and adoption models provide only anecdotal evidence to the failure of MSPs, which is why knowledge of factors that inhibit the diffusion of MSPs is particularly important. Scholars, therefore, call for a comprehensive and systematic investigation of factors inhibiting the diffusion of MSPs as well as for the development of new or the extension of existing technology diffusion and adoption models to increase their explanatory and predictive validity.

Network effects are a key characteristic and a crucial driver for the diffusion of MSPs. The impacts of diffusion-inhibiting factors on network effects have only been superficially examined in previous research. In contrast, the beneficial influence of network effects in the case of one- or two-sided platforms in conventional market relations between businesses and consumers (e.g., game consoles or service platforms such as Airbnb) has been thoroughly investigated. However, dependencies and areas of tension, which mainly occur in the diffusion of technology within or between different organizations (company to company context, B2B), have been neglected. Furthermore, case studies have often analyzed MSPs where management and ownership are carried out by a single organization. Nowadays, however, organizations are no longer isolated.

They create their values together and act in corporate networks. As a result, the highly complex management structure within these networks can also influence the diffusion of multi-sided platforms.

Dynamic B2B networks are characterized by intensive cooperation between loosely connected organizations in a fast-changing environment with a high degree of uncertainty. The organizations operating in the network are dependent on the rapid exchange of information with their competitors and are therefore in a co-operative and competing business relationship with them at the same time. The management structure within a dynamic B2B network is shared, the goods or services produced are easily interchangeable and are provided by several organizations. Although MSPs have been developed specifically for the interaction of different actors and offer a fast exchange of information between multiple organizations, the diffusion of these systems in dynamic B2B networks is particularly challenging.

In summary, MSPs depict new socio-technical information system artifacts that have so far been examined from a pro-innovative perspective. Their manifold interdependencies with institutions, markets, and technologies lead to a highly complex diffusion process in which, among others, internal and external organizational factors, as well as the individuals' pre- and post-adoption behavior must be taken into account. Previous research cannot provide sufficient explanation for why MSPs fail, especially in dynamic B2B networks where a large number of organizations operate dynamically in an environment with frequently changing business relationships.

Motivated by the limited explanatory and predictive validity of existing technology diffusion and adoption models for the investigation of multi-sided platforms in dynamic B2B networks, this thesis will examine factors inhibiting the diffusion of MSPs as well as their impact on network effects and on individuals' pre- and post-adoption behavior. For this purpose, five studies have been conducted to systematically illuminate various partial aspects of the diffusion of MSPs.

The first study (Article 1) identified 21 factors that inhibit the diffusion of MSPs in dynamic B2B networks. The second study (Article 2) examined the influence of these 21 inhibiting factors on network effects, which depict main drivers for the diffusion of MSPs. Studies three to five (Articles 3 - 5) each consider the influence of a specific inhibitory factor on individuals' pre- and post-adoption behavior. In detail, article 3

examines the extent to which specific technological features (factor *functionalities*) influence trust in technology and subsequently, the adoption of the technology. Article 4 examines the extent to which causal attributions (factor *blaming other actors*) influence users' information system continuance intention. Finally, article 5 analyses the extent to which users' continuance intention is influenced by the personality trait resistance to change (factor *spirit of innovations*).

Taken together, this thesis provides a deeper and more comprehensive understanding of the diffusion of MSPs in dynamic B2B networks. The systematical and comprehensive investigation of factors inhibiting the diffusion of MSPs in dynamic B2B networks contributes to answering various calls for research. By analyzing the relationships between factors inhibiting diffusion and network effects, this thesis contributes to research at the interface between platform and technology diffusion research. Alongside these contributions to research, each of the five articles contained an in-depth and comprehensive discussion on contributions to research and practice.

Zusammenfassung

Angespornt durch die zunehmende Digitalisierung und den Aufstieg von Technologieunternehmen wie Facebook, Airbnb oder Uber haben mehrseitige Plattformen in den vergangenen Jahren in verschiedensten Branchen verstärkt an Bedeutung gewonnen. Allgemein betrachtet stellen mehrseitige Plattformen einen elektronischen Marktplatz dar, bei dem zwei oder mehr Akteursgruppen miteinander interagieren und die Entscheidung einzelner Akteure das Entscheidungsverhalten der verbleibenden Akteure beeinflusst. Aufgrund ihrer dezentralen Beschaffenheit und ihrer Verflechtungen mit Institutionen, Märkten und Technologien stellen mehrseitige Plattformen einzigartige, neue, soziotechnische Artefakte dar und bieten Forschern daher ein spannendes und herausforderndes Forschungsobjekt.

Die bisherige Forschung zu mehrseitigen Plattformen unterliegt überwiegend einer pro-innovativen Sichtweise und hat eine große Menge an Wissen über Faktoren, welche den Erfolg von mehrseitigen Plattformen fördern, angesammelt. Der triumphale Erfolg und das explosionsartige Wachstum von mehrseitigen Plattformen, wie beispielsweise im Falle von Airbnb oder Uber, stellt jedoch eher die Ausnahme als die Regel dar. Ein Großteil der mehrseitigen Plattformen kämpft hart, um lebensfähig zu bleiben und verliert sogar oftmals diesen Kampf. Der Untergang einer mehrseitigen Plattform kann für Unternehmen einen massiven finanziellen Schaden bedeuten, was beispielsweise durch den 4-Milliarden-Dollar teuren Zusammenbruch von General Electrics Plattform „Predix“ offenbart wird. Zum Scheitern von mehrseitigen Plattformen können bestehende Technologiediffusions- und -adoptionsmodelle nur anekdotische Evidenz beitragen, weshalb das Wissen über Faktoren, welche die Diffusion von mehrseitigen Plattformen hemmen, von besonderer Bedeutung ist. Wissenschaftler fordern daher eine umfassende und systematische Untersuchung diffusionshemmender Faktoren sowie die Entwicklung neuer oder die Erweiterung von bestehenden Technologiediffusions- und -adoptionsmodellen, um deren erklärende und prädiktive Validität zu erhöhen.

Ein Schlüsselmerkmal und eine entscheidende Antriebskraft für die Diffusion von mehrseitigen Plattformen stellen Netzwerkeffekte dar. Die Auswirkung von diffusionshemmenden Faktoren auf Netzwerkeffekte wurde in der bisherigen Forschung nur oberflächlich beleuchtet. So wurde beispielsweise der vorteilhafte

Einfluss von Netzwerkeffekten bei ein- oder zweiseitigen Plattformen in konventionellen Marktbeziehungen zwischen Unternehmen und Konsumenten (u. a. Spielkonsolen oder Service-Plattformen wie Airbnb) untersucht. Abhängigkeiten und Spannungsfelder, die insbesondere bei der Technologiediffusion innerhalb von oder zwischen verschiedenen Organisationen auftreten (Unternehmen zu Unternehmen-Kontext, B2B), wurden hierbei bisher vernachlässigt. Darüber hinaus wurden in Fallstudien oftmals mehrseitige Plattformen analysiert, bei denen die Verwaltung und der Besitz durch eine einzelne Organisation erfolgt. Organisationen sind heutzutage jedoch nicht mehr isoliert, sie schaffen ihre Werte gemeinsam und agieren in Unternehmensnetzwerken. Infolgedessen kann die fortgeschrittene Verwaltungsstruktur innerhalb dieser Netzwerke auch die Diffusion von mehrseitigen Plattformen beeinflussen.

Dynamische B2B-Netzwerke zeichnen sich durch eine intensive Zusammenarbeit zwischen lose verbundenen Organisationen in einem sich schnell verändernden Umfeld mit hoher Unsicherheit aus. Die im Netzwerk agierenden Organisationen sind auf einen schnellen Informationsaustausch mit ihren Konkurrenten angewiesen und befinden sich daher mit diesen zeitgleich in einem kooperierenden und konkurrierenden Geschäftsverhältnis. Die Führungsstruktur innerhalb eines dynamischen B2B-Netzwerks ist geteilt, die produzierten Güter oder Dienstleistungen sind leicht austauschbar und werden von mehreren Organisationen bereitgestellt. Obwohl mehrseitige Plattformen speziell für die Interaktion von verschiedenen Akteuren entwickelt wurden und einen schnellen Informationsaustausch zwischen multiplen Organisationen bieten, gestaltet sich die Diffusion dieser Systeme in dynamischen B2B-Netzwerken als besonders herausfordernd.

Zusammenfassend stellen mehrseitige Plattformen neuartige soziotechnische Artefakte dar, welche bisher aus einer pro-innovativen Perspektive beleuchtet wurden. Ihre vielfältigen Verflechtungen mit Institutionen, Märkten und Technologien führen zu einem hochkomplexen Diffusionsprozess, bei dem u. a. organisationsinterne und organisationsexterne Faktoren, aber auch das individuelle Prä- und Postadoptionsverhalten des Nutzers berücksichtigt werden müssen. Die bisherige Forschung kann keine ausreichende Erklärung dafür liefern, warum mehrseitige Plattformen speziell in dynamischen B2B-Netzwerken scheitern, in denen eine Vielzahl

an Organisationen in einem Umfeld mit sich häufig ändernden Geschäftsbeziehungen dynamisch agieren.

Motiviert durch die geringe erklärende und prädiktive Validität bestehender Technologiediffusions- und -adoptionsmodelle zur Untersuchung von mehrseitigen Plattformen in dynamischen B2B-Netzwerken, sollen in dieser Dissertation diffusionshemmende Faktoren und ihre Auswirkungen auf Netzwerkeffekte sowie auf das individuelle Prä- und Postadoptionsverhalten beleuchtet werden. Hierzu wurden in fünf Studien verschiedene Teilaspekte der Diffusion von mehrseitigen Plattformen systematisch beleuchtet.

Im Rahmen der ersten Studie (Artikel 1) wurden 21 Faktoren identifiziert, welche die Diffusion von mehrseitigen Plattformen in dynamischen B2B-Netzwerken hemmen. In der zweiten Studie (Artikel 2) wurde der Einfluss der 21 hemmenden Faktoren auf Netzwerkeffekte, welche eine Hauptantriebskraft für die Diffusion von mehrseitigen Plattformen darstellen, beleuchtet. In den Studien drei bis fünf (Artikel 3 – 5) wird jeweils der Einfluss eines spezifischen hemmenden Faktors auf das individuelle Prä- und Postadoptionsverhalten betrachtet. Artikel 3 beleuchtet, inwieweit spezifische technologische Merkmale (Faktor *Funktionalitäten*) das Vertrauen in die Technologie und somit nachfolgend die Adoption der Technologie beeinflussen. Artikel 4 untersucht, inwieweit Kausalattributionen (Faktor *andere Akteure beschuldigen*) die Weiternutzungsabsicht eines Informationssystems beeinflussen. Artikel 5 analysiert, inwieweit die Weiternutzungsabsicht des Anwenders durch das Persönlichkeitsmerkmal Widerstand gegen Veränderungen (Faktor *Innovationsgeist*) beeinflusst wird.

Zusammengenommen ermöglicht diese Arbeit ein tieferes und detaillierteres Verständnis der Verbreitung von mehrseitigen Plattformen in dynamischen B2B-Netzwerken. Die systematische und umfassende Untersuchung von Faktoren, welche die Diffusion von mehrseitigen Plattformen in dynamischen B2B-Netzwerken hemmen, trägt zur Beantwortung verschiedener Forschungsaufforderungen bei. Durch die Analyse der Zusammenhänge zwischen diffusionshemmenden Faktoren und Netzwerkeffekten leistet diese Arbeit weiterhin einen wichtigen Beitrag zur Forschung an der Schnittstelle zwischen Plattform- und Technologiediffusionsforschung. Neben diesen Beiträgen zur Forschung werden in jedem der fünf enthaltenen Artikel praktische und theoretische Implikationen tiefgehend diskutiert.

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List of Abbreviations

ANOVA	Analysis of variance
AVE	Average Variance Extracted
B2B	Business to Business
B2C	Business to Consumer
C2C	Consumer to Consumer
CCS	Cloud Community Systems (used as Cargo Community System in Chapter 4)
CFA	Confirmatory Factor Analysis
CI	Continuance Intention
CR	Composite Reliability
ECIS	European Conference on Information Systems
ECT	Expectation-Confirmation Theory
EDI	Electronic Data Interchange
EVM	Experimental Vignette Methodology
ICIS	International Conference on Information Systems
ICT	Information and Communications Technology
IO	Information Overload
IOIS	Inter-organizational Information Systems
IS	Information System
ISCM	Information Systems Continuance Model
IT	Information Technology

MANOVA	Multivariate Analysis of Variance
MSP	Multi-Sided Platform
PU	Perceived Usefulness
RTC	Resistance to Change
SAT	Satisfaction
TBP	Travel Booking Platform
TOE	Technological, Organizational and Environmental
TOEI	Technological, Organizational Environmental and Inter-organizational

1 Introduction

1.1 Motivation and Research Question

Research on Information System (IS) adoption and use represent one of the most essential and comprehensive IS research areas (Burton-Jones et al. 2017). One reason is that the performance benefits of IS may not fully materialize unless IS technologies are being adopted and used (Setia et al. 2011). To understand the technology adoption and usage behavior of individuals and organizations, scholars have developed various models and frameworks over the last decades. Despite this comprehensive body of knowledge, new technological innovations, or increasing connectivity of information systems, lead to an additional need for further research (Burton-Jones et al. 2017).

Multi-Sided Platforms (MSPs) are one of these technological IS innovations, which has tremendously increased in popularity over the last decade. MSPs are a challenging research object because of their distributed nature and intertwining with institutions, markets, and technologies (de Reuver et al. 2018). On the one hand, the distributed nature, as well as the innumerable intertwining, lead to a highly complex diffusion process in which, among other things, internal and external organizational factors as well as individuals' pre- and post-adoption behavior must be taken into account (Kurnia et al. 2019). On the other hand, supported by these innumerable intertwined relationships, MSPs provide new opportunities for organizations to increase efficiency and flexibility at the same time (Benlian et al. 2018; Oliveira et al. 2014; Stummer et al. 2018). According to Hagiu and Wright (2015), MSPs are characterized by two main attributes: Firstly, an MSP enables direct interaction between two or more independent actor groups, each consisting of multiple users or organizations. Secondly, each considered actor group is connected to the platform (Hagiu and Wright 2015).

Previous MSP research has predominantly used a pro-innovation perspective and has investigated the triumphal march of platforms such as Airbnb or Uber (Abdelkafi et al. 2019; Chu and Manchanda 2016; Hsu et al. 2015a). The dark side of platforms, such as the \$4 billion collapses of General Electric's MSP "Predix", has rarely been considered. However, the failure of such MSPs and the enormous financial losses associated with them underline the vital need for further research (Scott et al. 2017). Although a large body of knowledge on factors that promote the success of MSPs has accumulated in research (de Reuver et al. 2018; Fichman et al. 2014), MSPs still often fail in practice.

Previous research contributed only anecdotal evidence and neglected the effects of inhibiting factors on network effects (de Reuver et al. 2018; Wang et al. 2019). Indeed, knowledge on factors inhibiting MSP diffusion is of particular importance to extend existing technology diffusion and adoption models and increase their explanatory and predictive validity. Taken together, these highlight both the practical and theoretical need to examine factors inhibiting the success of MSPs.

Respecting this research gap, recently, scholars have called for a deeper understanding of MSPs and notably of factors inhibiting MSP diffusion (de Reuver et al. 2018; Schrieck et al. 2018). Diffusion, in general, refers to the spread of technology within a network and requires *inter alia* individual adoption of the technology (Rogers 2010). For organizations, the diffusion of new IS technologies offers a vast potential to enhance operational efficiency and competitive agility for the long-term survival of organizations (Zhu and Kraemer 2005). The complexity associated with the IS diffusion between organizations is recognized by both science and practice (Burton-Jones et al. 2017; Liu et al. 2011; Wang et al. 2018). Scholars emphasize that, especially when introducing intra- as well as inter-organizational information systems, individuals' influence should be considered in addition to a purely organizational perspective (Benlian et al. 2018; Kurnia et al. 2019). They argue that a lack of consideration of individuals' influence can slow down or even stop the usage of the IS after the implementation. The reasons for this are that, for instance, users may be resistant to change and stick to their familiar workflows, or that they do not fully understand the information system (Chong et al. 2015; Liang et al. 2007). Instead, they may create and re-enact workarounds (Markus and Tanis 2000) or use shadow systems that prevent the intended use (Liang et al. 2007).

Network effects are a key characteristic and significant driver for the diffusion of MSP (Hagiu and Rothman 2016). Network effects arise when a critical mass of users is reached, and then adoption starts to kick in with exponential growth (Hagiu and Rothman 2016; Stummer et al. 2018). In general, a network effect is the marginal effect of an additional platform user on the existing benefits of another platform user. Scholars differentiate between four types of network effects: same-side and cross-side as well as positive and negative network effects. Same-side network effects emerge horizontally among organizations of the same actor group and express that changed benefits result from the participation of members on the same side of the platform.

In contrast, cross-side network effects emerge vertically between organizations of different actor groups and express the changing benefits result from the participation of members on a different side of the platform (Evans 2013; Farrell and Klemperer 2007; Parker et al. 2016; Stummer et al. 2018; Tiwana et al. 2010). Positive or negative indicates the change in benefit. Positive network effects increase the platform value of existing users, while negative network effects decrease this value (Thies et al. 2018).

While previous studies analyzed the role of network effects predominantly in the B2C (business to consumer) or C2C (consumer to consumer) context (e.g., Chu and Manchanda 2016; Thies et al. 2018; Voigt and Hinz 2015). This thesis focuses on network effects in the business to business (B2B) context, which so far has been scarcely considered. Existing literature predominantly concentrates on one- or two-sided platforms (Hagiu 2006) in conventional B2C markets such as game consoles or service platforms such as Airbnb (Chu and Manchanda 2016) and neglected dependencies and areas of tension which occur especially within or between different organizations. Moreover, scholars have examined several case studies in which a keystone firm owns and governs the platform (Ondrus et al. 2015; Otto and Jarke 2019; Tan et al. 2015). However, the platform landscape is becoming more and more diverse, and more complex governance and ownership structures are observed in different domains (Otto and Jarke 2019). In this respect, Hsu et al. (2015a) argue that the underlying deterministic view of technology diffusion is inadequate because this approach ignores the significance of institutional properties, interdependencies as well as market and governance structures. Nowadays, organizations are not isolated anymore. They create their values together and operate in business networks (de Reuver et al. 2018). As a result of this, the advanced governance structure within these networks can also influence the MSP diffusion (Choi et al. 2010; de Reuver et al. 2018). In the worldwide operating chemical industry, for instance, the platform “ELEMICA” constitutes a successful example of MSP diffusion (Christiaanse 2005). This successful diffusion is mostly attributed to the “lead-organization governed network” structure within the industry (Alt and Fleisch 2000; Son and Benbasat 2007), which is mostly prevalent in stable long-term buyer-supplier relationships such as traditional supply chains (Provan and Kenis 2008). Instead, the “shared-participant governed network” is the most common structure of B2B networks and prevalent in dynamic B2B networks, for instance, in the transport sector.

Dynamic B2B networks are determined by the structure and processes between organizations in a fast-changing environment with high uncertainty (Bhattacharya et al. 1998; Kutvonen et al. 2005). Structure in this context means that partnerships between multiple organizations in the network change frequently, and ad-hoc cooperation are common. These characteristics require high flexibility and interoperability, which is facilitated by the use of MSPs. The processes in dynamic B2B networks, especially in environments with high uncertainty, are usually characterized by continuous information updates and time-critical changes. These characteristics require real-time data provision and processing across actors, which can be enabled by MSPs (Aulkemeier et al. 2019). Despite the advantages of MSPs for organizations in dynamic B2B networks, the diffusion of MSPs fails in this particular area.

In a nutshell, previous literature on MSP diffusion takes a largely pro-innovative perspective (Hsu et al. 2015a). It cannot provide sufficient explanation of why MSP diffusion fails in dynamic B2B networks where multiple stakeholders dynamically operate in an environment of frequently changing relationships. In order to illuminate these white spots on the research map, this thesis examines the following two research questions:

RQ 1) What are the key inhibiting factors of MSP diffusion in dynamic B2B networks, and how do they influence the diffusion process?

RQ 2) To what extent do these inhibiting factors influence individuals' pre- and post-adoption behavior?

To answer these research questions, five studies were conducted. The corresponding articles are included in this thesis and have already been published in IS research outlets. The structure of the thesis is discussed in detail in the next section.

1.2 Thesis Structure and Synopses

The thesis contains eight chapters. In the introduction (Chapter 1), the motivation of the thesis and the formulation of two overarching research questions are presented. In the second chapter, the theoretical foundations of dynamic B2B networks, as well as of MSP diffusion and assimilation, are outlined. In this section, the relationship between individuals' pre- and post-adoption behavior, intra-organizational technology assimilation, and inter-organizational technology diffusion will be illustrated. In chapters three to seven, five distinct research articles are presented. All of them contribute to

answering the two overarching research questions and have already been published in peer-reviewed IS outlets. To ensure a consistent layout in this thesis, the originally published versions of the five articles were slightly revised. The five articles included in this thesis and their respective publication outlets and dates are:

Chapter 3 (Article 1)	Factors Inhibiting the diffusion of Multi-Sided Platforms Wallbach, S.; Coleman, K.; Elbert, R. (2018) <i>“Factors Inhibiting the Adoption of Cloud Community Systems in Dynamic B2B Networks: The Case of Air Cargo.”</i> In: 39 th International Conference on Information Systems (ICIS), San Francisco, USA. VHB: A
Chapter 4 (Article 2)	The Impact of Inhibitors on Network Effects Wallbach, S.; Coleman, K.; Elbert, R.; Benlian, A. (2019) <i>“Multi-sided platform diffusion in competitive B2B networks: inhibiting factors and their impact on network effects.”</i> In: Electronic Markets, 29(4), 693-710. VHB: B
Chapter 5 (Article 3)	Trust-Building Influence of Technological Features on Users’ Pre-adoption Behavior Wallbach, S.; Lehner, R.; Röthke, K.; Elbert, R.; Benlian, A. (2020) <i>“Trust-Building Effects of Blockchain Features – An Empirical Analysis of Immutability, Traceability and Anonymity.”</i> In: 28 th European Conference on Information Systems (ECIS), A Virtual AIS Conference. VHB: B
Chapter 6 (Article 4)	Effects of Causal Attributions on Users’ Post-adoption Behavior Wallbach, S.; Haag, S. (2018) <i>“Who Is to Blame? How Too Much Information Threatens Users’ Continuance Intention – An Experimental Analysis.”</i> In: 27 th European Conference on Information Systems (ECIS). Portsmouth, United Kingdom. VHB: B
Chapter 7 (Article 5)	Effects of Users’ Resistance to Change on Their Post-adoption Behavior Grupp, T; Wallbach, S.; Croitor, E. (2020) <i>“The Role of Resistance to Change in Software Updates’ Impact on Information Systems Continuance.”</i> In: 28 th European Conference on Information Systems (ECIS), A Virtual AIS Conference. VHB: B

Table 1: Overview of the included research articles.

In order to provide a comprehensive overview of the relationships between these articles, Figure 1 illustrates the MSP diffusion process in dynamic B2B networks, including the positioning of the five articles. In more detail, the figure depicts the relationships between different groups of actors acting on various platform sites (represented by Actor

group A, Actor group B, Actor group C). Each actor group can contain several actors (symbolized by A1, A2, B1, B2, C1, C2), which also interact with each other. Arrows indicate the connections between the individual actors as well as between the actor groups. Boxes with dotted lines highlight the positioning of the research articles. In article 1 (Chapter 3), 21 factors inhibiting the MSP diffusion in dynamic B2B networks, including their influence on the intra-organizational MSP assimilation process, were revealed. Article 2 (Chapter 4) deals with the influence of inhibiting factors on network effects, which constitutes key drivers of MSP diffusion. Articles 3 - 5 (Chapters 5 - 7) each deal with the influence of a specific factor on individuals' pre- and post-adoption behavior. Chapter eight concludes the thesis with a summary of the contributions to research and practice.

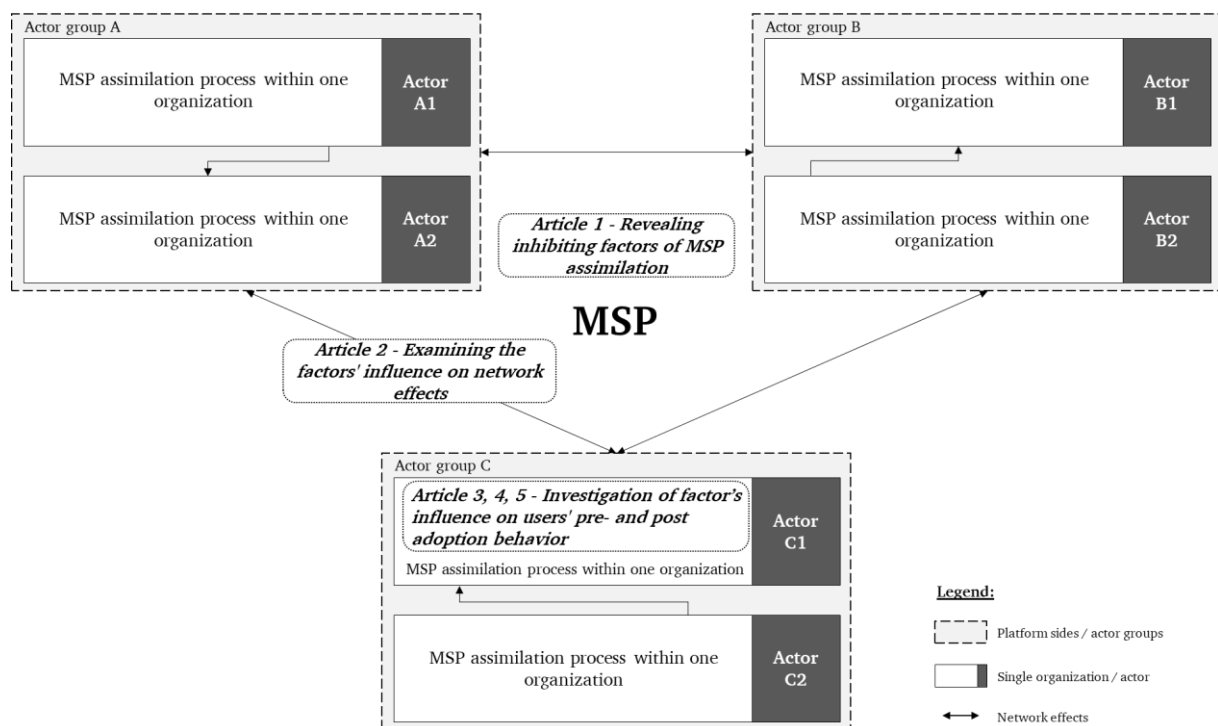


Figure 1: MSP diffusion process, including positioning of the research articles.

In addition to the publications listed above, the following articles were also published or submitted for publication during my time as a Ph.D. candidate. These articles are, however, not part of the thesis:

Elbert, R.; Scharf, K.; Wallbach, S.; Benlian, A. (2018) „LogIn – Analyse der Akzeptanz von aktorsübergreifenden Cargo Community Systemen in der Luftfracht“
In: Forschungsbericht des Fachgebiets Unternehmensführung und Logistik.

Thies, F.; Wessel, M.; Wallbach, S.; Besler, M.; Benlian, A. *“Initial Coin Offerings and the Cryptocurrency Hype: The Moderating Role of Exogenous and Endogenous Signals”* (under review at the 41st International Conference on Information Systems (ICIS) 2020)

Subsequently, short summaries of the five research articles (i.e., Chapters 3 to 7, for an overview, see Table 1) are presented. Each summary includes the motivation for the respective study, the methodical approach, the main findings, as well as the contribution to answering the overarching research question of this thesis. Since the studies were conducted with co-authors and therefore also reflect their opinions, the summaries and articles were written in the first-person plural perspective (i.e., we).

Article 1 – Chapter 3: Factors Inhibiting the diffusion of Multi-Sided Platforms

Although research on IS adoption is already very mature, there are still several research gaps that require further scrutiny. One of these research gaps is the inter-organizational adoption of IS in dynamic B2B networks. The existing body of knowledge cannot adequately explain why the adoption of information systems in this context often fails or progresses only slowly. Furthermore, previous IS research often discusses advantages or possibilities, such as factors promoting IS adoption. However, factors inhibiting IS adoption are also of central importance because they can explain why an advantageous appearing IS is not adapted.

Cloud community systems (CCS) represent a particular MSP, which among other things, serves for inter-organizational information exchange and cooperation. To reveal the factors inhibiting the CCS adoption, we have used a grounded theory approach and conducted 15 interviews with strategic and operative employees. We chose the Frankfurt air cargo hub as a suitable research case because the air cargo sector represents a dynamic B2B network with a high number of actors. Furthermore, due to fragmented tasks within the transport network, the actors compete and cooperate at the same time (co-opetition).

In sum, we analyzed more than 20.5 hours of interview data and developed 21 factors inhibiting CCS adoption. To compare the factors with the existing literature, we have classified the 21 factors along the technological, organizational, and environmental (TOE) framework. By doing so, it became evident that our 21 inhibiting factors could not be fully assigned to the three existing TOE contexts. Consequently, we extended the

TOE framework with the context I (inter-organizational), which constitutes a necessary extension due to the increasing interaction of organizations in dynamic B2B networks. In addition, a comparison with the existing literature showed that we identified seven new, two new/restructured, four extended, and eight existing factors inhibiting the adoption of CCS in dynamic B2B networks.

Our study has several implications for research and practice and contributes actively to the sparse existing research on MSP diffusion in dynamic B2B networks. Concerning the overarching research questions, especially the 21 factors identified, represent an essential contribution to research. In particular, our seven new inhibiting factors are of considerable interest for two reasons. Firstly, we contribute to a more critical consideration of IS research in general, and MSP research in particular, by analyzing factors inhibiting MSP diffusion. This stands in contrast to the often existing pro-innovative view IS adoption and are explicitly demanded by Jede and Teuteberg (2016) as well as by Kembro et al. (2017). In this way, we provide new stimuli to enlarge the collective perspectives of existing IS research and broaden the theoretical lenses. Secondly, our revealed factors offer new insights for the diffusion process of MSP in an inter-organizational context. In particular, the factors arising from the tensions between different organizations offer a new perspective on how the diffusion of MSP between different organizations takes place. Furthermore, due to the necessary reclassification of two factors, we have expanded the existing literature. Moreover, by confirming eight existing factors, we are strengthening their existing predictive power, demonstrating their existence in the context of CCS and thereby enhancing their universal validity.

Article 2 – Chapter 4: The Impact of Inhibitors on Network Effects

Multi-sided platforms have tremendously increased in popularity over the last decade. For organizations, MSPs provide new opportunities to increase efficiency and flexibility at the same time. Although a comprehensive body of knowledge of factors that promote the success of MSPs has accumulated in research, MSPs still often fail in practice. Moreover, previous research contributed only anecdotal evidence and neglected the effects of inhibiting factors on network effects. Indeed, knowledge about factors inhibiting MSP diffusion is of particular importance to extend existing technology diffusion and adoption models and increase their explanatory and predictive validity.

By using the air cargo hub in Frankfurt, Germany, as a highly competitive and dynamic B2B network that struggles with the acceptance of an MSP for over ten years, we applied a grounded theory approach to identify key inhibitors to MSP diffusion as well as their impact on network effects. We conducted interviews in 15 different organizations with more than 20 strategic and operational employees. In this way, we were able to identify 21 inhibiting factors, of which five factors mainly influence intra-organizational assimilation, and thus are not expected to have an impact on network effects. In contrast, the remaining 16 factors slow down or even thwarts positive network effects, typically occurring on MSP diffusion.

In more detail, out of the 16 factors, nine factors were identified as having an impact on cross-side network effects, two on same-side network effects, and five on both same- and cross-side network effects, which we called mixed-side network effects. Surprisingly, we could not discover any evidence for negative network effects caused by platform usage. One explanation for this might be that the transport sector in general and the air cargo sector, in particular, live by a “hands-on” mentality characterized by fast and uncomplicated problem-solving. This pragmatic solution-oriented approach of the people in the sector could have led to the fact that our interviewees did not perceive any negative network effects of using the platform (despite explicit questioning about possible negative effects).

Our results contribute in various ways to existing research. Among other things, we heed calls for research from de Reuver et al. (2018), Schreieck et al. (2018), Hong et al. (2013) and Te'eni (2015) which call for a deeper understanding of MSPs and in particular of the factors inhibiting MSP diffusion as well as for a stronger contextualization of studies. Considering the overarching research questions, this study contributes specifically to the research at the interface between platform and technology diffusion research. Network effects are a core element of MSP diffusion and often determine the fate of MSPs for the better or worse. Previous research has only provided anecdotal evidence of the effects of inhibiting factors on network effects and has overlooked to examine their intricate interrelationships. We shed a nuanced light on the impact of inhibiting factors on same-side and cross-side network effects to better understand which factors exactly influence which type of network effects. Furthermore, we proposed a new category of network effects, called mixed-side network effects, which

covers factors influencing same- and cross-side network effects simultaneously. By identifying and categorizing inhibiting factor, we enable scholars to manipulate factors influencing cross-, same- or mixed-side network effects in an isolated or joint manner, so that scholars can understand the diffusion of MSP on a deeper level.

Article 3 – Chapter 5: Trust-Building Influence of Technological Features on Users' Pre-adoption Behavior

Research on MSP diffusion in dynamic B2B networks has shown that lack of trust in the system or a lack of functionalities of the technology (such as the protection of information against modification) inhibits the system's diffusion. Moreover, trust in technology is an essential factor influencing the success of IS and particularly individuals' pre-adoption behavior. However, it is still unknown to what extent technological features themselves can influence trust in technology and, thus, also its subsequent adoption.

The blockchain technology offers unique technological features such as immutability of transactions, traceability of all entries and anonymity of actors. In general, a Blockchain is "a distributed ledger technology in the form of a distributed transactional database, secured by cryptography, and governed by a consensus mechanism" (Beck et al. 2017, p. 381). In recent years, blockchain technology has received enormous attention in both research and practice, and both sides have equally recognized its potential. The rapid spread of the technology began in the financial sector, but prototypical platforms and applications meanwhile also exist in many other industries, such as the transport industry. Within the transportation industry, for instance, Maersk and IBM have developed the blockchain-based platform "TradeLense" to reduce bureaucracy within this sector, improve supply chain visibility, and eliminate inefficiencies through paper-based processes.

Although scholars attest the blockchain technology an enormous potential, research on blockchain and especially on trust in the blockchain is still in its infancy. Previous research does not address the influences on trust emanating from the main features of blockchain technology, i.e., immutability, traceability, and anonymity. Based on a qualitative study, Sas and Khairuddin (2017) were able to gain first insights and revealed that these features are related to trust in blockchain technology. However, scholars were not yet able to provide empirical evidence for this critical relationship. To fill this research gap, we conducted a scenario-based experimental study with 455 participants.

We analyzed the trust-building effect of three technological features (i.e., immutability and traceability of information as well as an anonymous use of the technology), which can be found in current implementations of blockchain-based platforms and applications. By doing so, we show that immutability and traceability positively and anonymity negatively influence trust in technology. In addition, anonymity moderates the effect of immutability, showing that in highly anonymous blockchains environments, the immutability of information is more relevant.

With this study, we contribute to answering the second overarching research question. Previous research on MSP diffusion (see Chapters 3 and 4) points to the influence of the inhibiting factor *functionalities*, which deals with missing features, functions, or modules of the platform or technology. The authors classify this factor as "strategic", meaning that this factor mainly affects the pre-adoption phase, which is influenced by trust in technology. Our study is one of the first empirical studies which investigate the effects of selected blockchain features in an isolated manner. We have built on previous results from qualitative research and have empirically demonstrated the impact of the blockchain features immutability, traceability and anonymity on trust in technology. By doing so, we were able to demonstrate empirically that selected technological features are capable of influencing trust in technology and, consequently, individuals' pre-adoption behavior. Moreover, by revealing the interaction between the anonymous use of technology and the immutability of information, we also show that there is an interplay between technological and social control mechanisms, which also represent an important influencing factor of individuals' behavior.

Article 4 – Chapter 6: Effects of Causal Attributions on Users' Post-adoption Behavior

The rapid development of innovation in the area of information systems leads to a ubiquitous presence of information and communications technology in people's everyday life. Ubiquitous computing offers many opportunities for humans, as the availability of information at any time and any location. Nowadays, this kind of information availability is common for humans, and they claim this characteristic or other features for novel applications. Therefore, software providers develop more powerful applications with rich features. The dark side, however, is that this approach also creates more complex applications and information overload.

Information overload describes the cognitive conditions of a person when the actual amount of information exceeds the individual information processing capacity and leads to stress or frustration. The IS literature has widely recognized that stress caused by information and communications technologies is an increasingly ubiquitous phenomenon both in our workplaces and in the private environment (Benlian 2020). Xu (2016), for instance, found that stress or frustration caused by complex websites, in turn, decreases user satisfaction and induces users to decrease their usage of the website. However, studies in consumer research building on attribution theory show that users' reactions to a product failure depend on the attributed cause of product failure.

Transferring those findings, we argue that different attributions of blame for information overload could also cause different user reactions regarding IS use. In particular, we analyze the effects of internal (attribute to themselves) and external (attribute to the information system) attributions of blame for information overload on users' continuance intention. To explore these effects, we build on and contextualize Bhattacharjee's information system continuance model, extend it with the construct information overload, and tested it by using a scenario-based online experiment. By doing so, we were able to manipulate information overload as well as the locus of the attribution of blame in an isolated way. Our results show that satisfaction and perceived usefulness fully mediate the negative effect of information overload on users' continuance intention. Furthermore, we revealed that an internal attribution of blame is associated with a higher continuance intention than an external attribution of blame.

Our results provide numerous contributions to existing IS research and contribute to answering the second overarching research question of this thesis. Research on the diffusion of MSP revealed that the factor "blaming other actors" inhibits the diffusion of platforms in dynamic B2B networks (see Chapters 3 and 4). In light of attribution theory, this factor corresponds to a causal attribution. Nonetheless, the effects of causal attributions on users' continuance intention, which represents the third stage within an organizational MSP assimilation process, have been neglected so far. Moreover, attribution theory, which is rooted in psychology, is increasingly attracting attention in other areas of research, such as Finance. However, we did not find any study that followed the call of Martinko et al. (2011) to explain IS adoption and use behavior-based on attribution theory. We demonstrated that attributions of blame for information

overload affect users' IS continuance intention, and therefore we provide a springboard for further research of causal attributions in the context of IS. Moreover, our results indicate that causal attributions can have a vital influence on the intra-organizational assimilation of MSP and constitutes a new obstacle that could slow down or even stop the intra-organizational MSP assimilation process in the post-adoption phase. In essence, this suggests that if an operational user in an organization does not attribute the locus of a negative or undesirable outcome of an MSP to itself (but to the MSP or another actor), it reduces the user's continuance intention of the MSP. This, in turn, can lead to the emergence of an assimilation gap and thus slow down or even stop the MSP assimilation in organizations.

Article 5 – Chapter 7: Effects of Users' Resistance to Change on Their Post-adoption Behavior

To reduce time-to-market and keep pace with changing requirements, software providers increasingly release a lean version of their product instead of shipping a feature-complete product right from the start. In this way, software providers subsequently enhance the product through updates, while it is already being used. Because updates change the software during use, they may influence users' post-adoption beliefs and attitudes and thus even affect their intentions to continue using the software. Research on software users' post-adoption beliefs and attitudes regarding software updates and individual differences has so far been minimal. Fleischmann et al. (2016) are among the first to explore the effect of feature updates in a controlled laboratory experiment from a user perspective, however neglecting the fact that users can differ in the way they receive and assess changes. Differences regarding individuals' disposition to cope with changes can be conceptualized as a personality trait.

To date, personality traits as antecedents of perpetual beliefs or moderators have only been sparsely considered in IS adoption or post-adoption models. Therefore, many scholars call for better integration of individual differences into IS research to increase our understanding of IS adoption and post-adoption behavioral intentions. Particularly, Maier (2012) identifies resistance to change (RTC) as a personality trait that has been mostly neglected by IS research despite promising new insights. Previous insights from organizational research suggest significant differences in reactions between more and less change-resistant individuals that are faced with change. Consequently, it appears

relevant to examine the effects of this personality trait in post-adoption settings more thoroughly.

To investigate this research gap, we draw on the IS continuance model and theory of resistance to change and investigate whether and how feature updates differently affect the continuance intentions of users that are more vs. less resistant to change. Using a scenario-based online experiment with 149 participants, we find a positive effect of feature updates on the continuance intentions of less change resistant-users. However, the effect disappears for more change-resistant users. Furthermore, a moderated mediation analysis reveals positive disconfirmation as a mediating mechanism that is contingent on users' resistance to change.

With this study, we contribute in several ways to IS research and addresses our second overarching research question. Previous research on MSP diffusion (see Chapters 3 and 4) points to the influence of the inhibiting factor *spirit of innovation*, which deals with individuals' disposition to deal with changes, such as the lack of recognition of the need for innovation. By showing that reactions to feature updates are different between users with weak versus strong dispositions to resist change, we heed calls for research from Maier (2012) and contributes to the body of knowledge in personality traits research. In detail, more change-resistant users do not show a significant positive response to features that are received from an update compared to situations in which they have the entire feature set from the beginning. In contrast, less change-resistant users that receive features through an update show a positive reaction in terms of their continuance intention. This is surprising since users who have all functions available to them from the beginning should have a higher overall benefit and thus a higher continuance intention. However, it turned out that people who receive the functions late due to the updates have a higher CI, that challenges the idea of a rational user, whose view is often used in IS literature. These diverging findings for different types of users emphasize the importance of joint consideration of individuals' differences when investigating their continuance intention.

Considering our results through the lenses of platform diffusion, they suggest that regardless of user resistance to change, it is an advisable strategy to postpone software functionality and distribute it later via updates. For users who are less resistant to change, feature updates can significantly increase their CI to exceed the CI of feature-

complete solutions far. In contrast, more change-resistant users will not be affected by the same strategy and will keep CI on a similar level. Due to the unexpected and positive surprise caused by the additional functionality provided by the update, subjects seemed to experience a positive disconfirmation of previous expectations, which leads to a higher CI. This implies that by this strategy, the CI of specific users can be increased while it can be kept at the same high level for the remaining users. In turn, a higher CI reduces the risk of a possible assimilation gap and thus fosters the diffusion of the platform.

2 Theoretical Foundations

2.1 Dynamic B2B Networks

In mature and established industry sectors, such as chemical industry or air cargo, competition and processes are already in place and prevent the fast spread of new shared IS technologies or infrastructures, such as MSPs (Christiaanse and Sinnecker 2001; Son and Benbasat 2007). However, these shared IS technologies are highly valuable to facilitate inter-organizational communication and thus increase cooperation and process efficiency (Oliveira et al. 2014). The diffusion of new, shared IS technologies in a B2B network is challenging, especially in shared-participant governed networks, which are a common form of B2B networks (Backhouse et al. 2006; Provan and Kenis 2008). In reality, a large number of different organizations working together as equal partners in B2B networks lead to various communication channels with a low degree of standardization (Backhouse et al. 2006; Boukef Charki et al. 2011; De Vries et al. 2003). To differentiate their services and to fulfill the demands, organizations have to offer a range of (full and partial) product- and service-related solutions. Consequently, in an inter-organizational context and especially in shared-participant governed networks, a tremendous effort for communication and coordination arises (Aulkemeier et al. 2019). In this context, IS technologies enable organizations to deal with a real and continuously changing environment (Bruque Camara et al. 2015).

Based on the characterization of competitive models by Farahani et al. (2014), three types of B2B networks can be differentiated (see Figure 2): Non-dynamic B2B networks, semi-dynamic B2B networks, and highly-dynamic B2B networks. It is noteworthy that the classification is not a rigid separation, but rather a continuum.

Common market structure	[quasi-] monopolistic (no or weak competition)	oligopolistic (imperfect competition)	polypolistic (perfect competition)
Market share Market barriers Market price control of individual organizations	high		low
Regulation imposed by	government		market
Product or service characteristics	unique		interchangeable
Common governance structure	lead-organization governed network	lead-organization governed network	shared participant governed network
B2B network structure	weak or non-dynamic B2B network	conventional or semi-dynamic B2B network	pure or highly-dynamic B2B network

Figure 2: Characterization of B2B networks, including their attributes.

In non-dynamic B2B networks, monopoly structures are prevalent, high market entry barriers often exist, and products or services are not substitutable. Furthermore, the involved participants often maintain long-term business relationships with each other. Existing governance mechanisms that define roles, responsibilities, and processes in the corporate network are clearly defined and established (Aulkemeier et al. 2019).

In contrast, highly dynamic B2B networks (or simply called dynamic B2B networks) are characterized by lively cooperation between loosely connected organizations in a fast-changing environment with high uncertainty (Bhattacharya et al. 1998; Kutvonen et al. 2005). Moreover, polypolistic market structures are prevalent, goods or services are easily substitutable and provided by multiple organizations, and organizations only have little price control with rather low margins. Other important criteria are that multiple stakeholders interact in the network, business relationships are loose and vary dynamically in the network, and ad-hoc cooperation is part of the daily business activities. The governance structure is shared and no leading organization has sufficient market position to mandate the use of a specific IS.

Finally, semi-dynamic B2B networks represent the middle between these two extremes and are characterized by oligopolistic market structures and moderate market entry barriers.

Especially for the requested partial service solutions, organizations in dynamic B2B networks might rely on information exchange with their competitors. This results in a quagmire where organizations must cooperate and compete at the same time (Christ et al. 2017). Recent research deals with this quagmire called “co-opetition” (e.g., Hoffmann et al. 2018; Mathias et al. 2017; Pitelis et al. 2017), whereby different organizational interests must be coordinated resulting in highly complex dynamic B2B network structures. The processes within dynamic B2B networks are prone to continuous updates and most often require fast responses in order to keep the promised service level. Furthermore, the links between organizations must enable quick connect and disconnect relationships in order to harness market opportunities (Aulkemeier et al. 2019).

There is a consensus in the IS community that IS diffusion is not just a technical matter but involves social and political aspects (Backhouse et al. 2006; Hanseth et al. 2006; Zhao et al. 2011). In contrast to individuals’ or intra-organizational IS adoption, where an individual or the board of directors primarily decides on the adoption of an IS, in dynamic B2B networks, the behavior of other organizations additionally influences this decision. However, research on this is still in its infancy, which is why Aarikka-Stenroos and Ritala (2017), for example, highlight that particularly dynamic B2B networks need further theoretical and empirical consideration because findings on the MSP diffusion on B2C networks cannot be transferred to their full extent. Furthermore, to date, state of the art inter-organizational collaboration relies on static collaboration patterns between individual partners, and current systems are engineered without interoperability in mind. Thus, scholars claim that in particular, in dynamic B2B networks, information technology platforms are necessary to enhance a quick connect capability between organizations (Aulkemeier et al. 2019).

2.2 Diffusion and Assimilation of Multi-Sided Platforms

Recently, MSPs have become prominent in the economy, primarily due to the internet and digitization wave across many industries (Abdelkafi et al. 2019). MSPs coordinate the requirements of more than two different actor groups, which are, to some extent, dependent on each other (Evans 2003; Evans 2013; Parker et al. 2016). Their ecosystem

consists of platform providers, providers of additional products, services or modules (i.e., complementors) and users (Jacobides et al. 2018). MSPs play an important role throughout the economy, as they minimize transactions costs between market sides (e.g., Hagiu 2006). Furthermore, due to their adaptability and ability to handle complexity, rapid scale-up, and value capture, MSPs appear to be the most influential business models in the digital economy (Abdelkafi et al. 2019). Mighty success examples of MSPs such as Airbnb or Uber have demonstrated noticeable growth and achieved high financial valuations. Nevertheless, many MSP implementations still fail in practice, such as the \$4 billion collapses of General Electric's MSP "Predix" (Abdelkafi et al. 2019; Scott et al. 2017).

There is consensus in the research community that MSPs are of sociotechnical nature, as they comprise various technical and organizational facets as well as multiple forms of interaction of the MSP with its dynamic environment on a technical, organizational and individual level (Otto and Jarke 2019; Tiwana et al. 2010). Consequently, the diffusion of an MSP is a dynamic and complicated process that cannot be fully explained by existing research (Staykova and Damsgaard 2017). Despite general arguments regarding the benefits of platforms, both academia and industry are concerned about the continued slow, painful process of diffusion and the many cases of failure that result in failing to reach their expected performance value (Rai et al. 2006; Saraf et al. 2013; Zhang et al. 2016). However, due to the distributed nature of MSPs, they will only develop their potential and performance value if they are accepted and used by multiple actors, which are organizations in the B2B context (de Reuver et al. 2018; Wright et al. 2017).

The adoption of IS, and thus also from MSPs, within and between several organizations in a network is more complex compared to individual IS adoption (Benlian et al. 2018). Therefore, in order to investigate organizational IS adoption scholars use a granular assimilation process (Bruque Camara et al. 2015; Oliveira and Martins 2011). Despite the variety of formal definitions of assimilation in the literature (e.g., Lai et al. 2016; Wei et al. 2015; Zhu et al. 2006a), all agree that assimilation mainly refers to the extent to which an organization has progressed through the three stages of innovation deployment (Lai et al. 2016; Zhu et al. 2006b). These stages are: first, the initial initiation or perception (awareness), second, the formal adoption and usage (adoption), and third, the final full-scale deployment (routinization) of an IS technology (Wright et

al. 2017; Zhu et al. 2006c). The required decisions within these stages are performed by strategic and operative employees and thus influenced by their pre- and post-adoption behavior. As illustrated in Figure 3, in the course of the assimilation process, the influence and decision making shifts from strategic to operational employees (Bruque Camara et al. 2015).

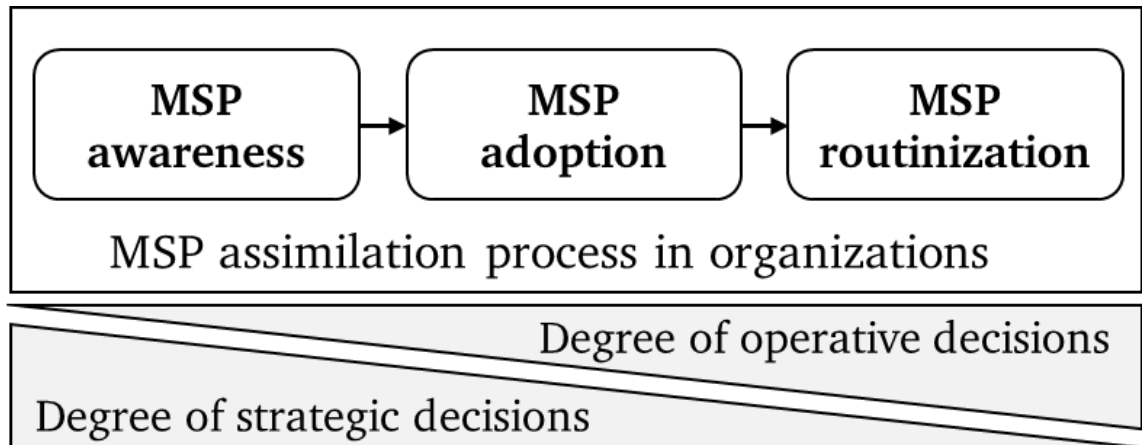


Figure 3: MSP assimilation process, including levels of influence.

In the early stages of the assimilation process, like the transition from awareness to adoption, the top management primarily takes the decision for or against an IS technology, and initiates the intra-organizational adoption (Power and Gruner 2017). In this context, scholars pointed out that the adoption decision of an IS depends on the manager's different subjective interpretations of the urgency and importance of the IS (Hsu et al. 2015a; Lai et al. 2016; Power and Gruner 2017). In contrast, in later stages like the transition from adoption to routinization, the degree of the IS adoption decision making shifts from the strategic to the operative level. In these later stages, the involvement of the operative level is crucial because employees have to become familiar with the technology to accomplish their tasks and daily processes (Gupta et al. 2018; Wu and Chiu 2018).

A possible slow down or even stop of the assimilation process in the later phase is called “assimilation gap” (e.g., Liang et al. 2007; Mu et al. 2015; Wright et al. 2017). Causes for this gap are, for example, the use of workarounds or shadow systems implemented by change-resistant users who stick to their old, familiar working methods (Chong et al. 2015; Liang et al. 2007). Overall, this illustrates that on the one hand individuals’ pre- and post-adoption behavior is subject to specific influences and that, on the other hand,

individuals' pre- and post-adoption behavior influences the organizational MSP assimilation process.

Network effects (or network externalities) can lead to an exponential growth of a platform and are therefore considered a key driver of MSP diffusion. A network effect is the marginal effect of an additional platform user on the real benefits of another platform user. Typically, the powerful impact of network effects starts when the problem of mutual baiting (often called chicken-and-egg dilemma) is solved (Parker et al. 2016; Stummer et al. 2018). The chicken-and-egg dilemma deals with the situation that organizations use a platform only when it offers a benefit. However, the benefit of the platform results from the increasing number of organizations using the platform. At first, this predicament seems to be unsolvable. However, a closer look reveals that when it is solved, a self-reinforcing effect occurs (Arroyo-Barrigüete et al. 2010; Wan et al. 2017). The literature considers the chicken-and-egg dilemma as solved when a critical mass of individuals or organizations participate on a platform side. The critical mass is present when the relationship between additional and quitting actors is positive (Tiwana 2013).

Previous literature differentiates between four types of network effects: same-side (or direct) and cross-side (or indirect) as well as positive and negative network effects. Same-side network effects emerge horizontally among organizations of the same actor group and express that changed benefits result from the participation of members on the same side of the platform. In contrast, cross-side network effects emerge vertically between organizations of different actor groups and express the changing benefits result from the participation of members on a different side of the platform (Evans 2013; Farrell and Klemperer 2007; Parker et al. 2016; Stummer et al. 2018; Tiwana et al. 2010). Noteworthy cross-side network effects appear more often than same-side network effects, and they are not necessarily symmetrical (Arroyo-Barrigüete et al. 2010; Parker et al. 2016; Wan et al. 2017). Positive or negative indicates the change in benefit. Positive and negative network effects indicate the change in the network utility caused by an additional subscriber (Shapiro and Varian 1998). A positive network utility exists, for example, in the use of messaging services such as fax or real-time collaboration tools such as Skype for Business. If one additional person uses the service, the utility of the entire network rises because opportunities to communicate increase. In the case of negative network effects, the benefit of using the platform decreases with an additional

subscriber because, for instance, the performance of the platform declines (Shapiro and Varian 1998). Figure 4 illustrates the relationships of cross- and same-side network effects in MSPs.

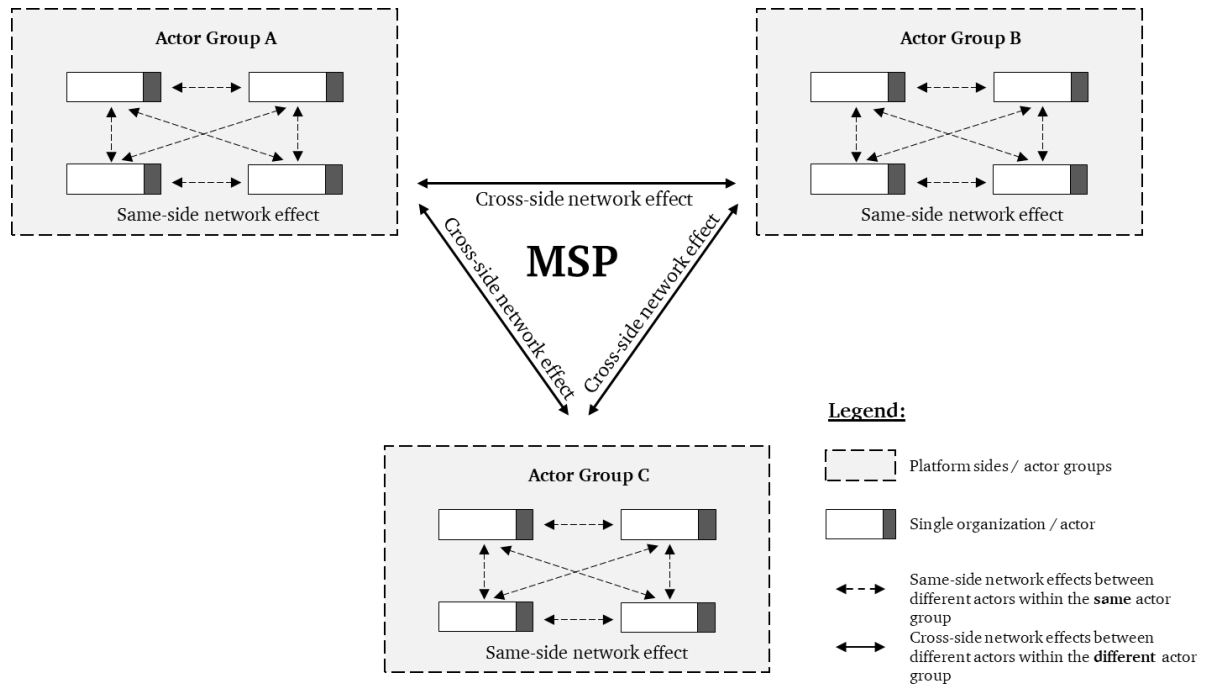


Figure 4: Relationships of cross- and same-side network effects in MSPs.

The self-reinforcing characteristic of network effects influences multiple stages of the intra-organizational assimilation as well as of the inter-organizational diffusion process. Generally, diffusion requires the usage of technology and is “a kind of social change, defined as the process by which alteration occurs in the structure and function of a social system” (Rogers 2010, p. 6). Rogers diffusion of innovations theory constitutes one of the most prominent theories in assimilation and diffusion literature (e.g., Angst and Agarwal 2009; Oliveira et al. 2014; Wright et al. 2017). While the original theory was designed to explain the individual perspective of diffusion, scholars have broadened their lenses and adopted the underlying concept to the inner-organizational context (Wright et al. 2017; Zhu et al. 2006c). Thus, the theory is in accordance with the three-stage intra-organizational assimilation process.

Applying these theoretical insights to MSP diffusion, the three-stage intra-organizational assimilation process influences the inter-organizational MSP diffusion. Simply put, the MSP diffusion process is regarded as a multiple intra-organizational assimilation process in which every single stage can influence succeeding stages as well as single stages of

the assimilation process within other organizations, including the underlying pre- and post-adoption behavior of users (see Figure 5). More specifically: Firstly, one single stage can influence the progress within one organization (intra-organizational assimilation process) and thus also individuals' pre- or post-adoption behavior. Secondly, one stage can influence the progress between several organizations within the same actor group (induced by same-side network effects). Thirdly, one stage can influence the progress between several organizations of different actor groups (induced by cross-side network effects).

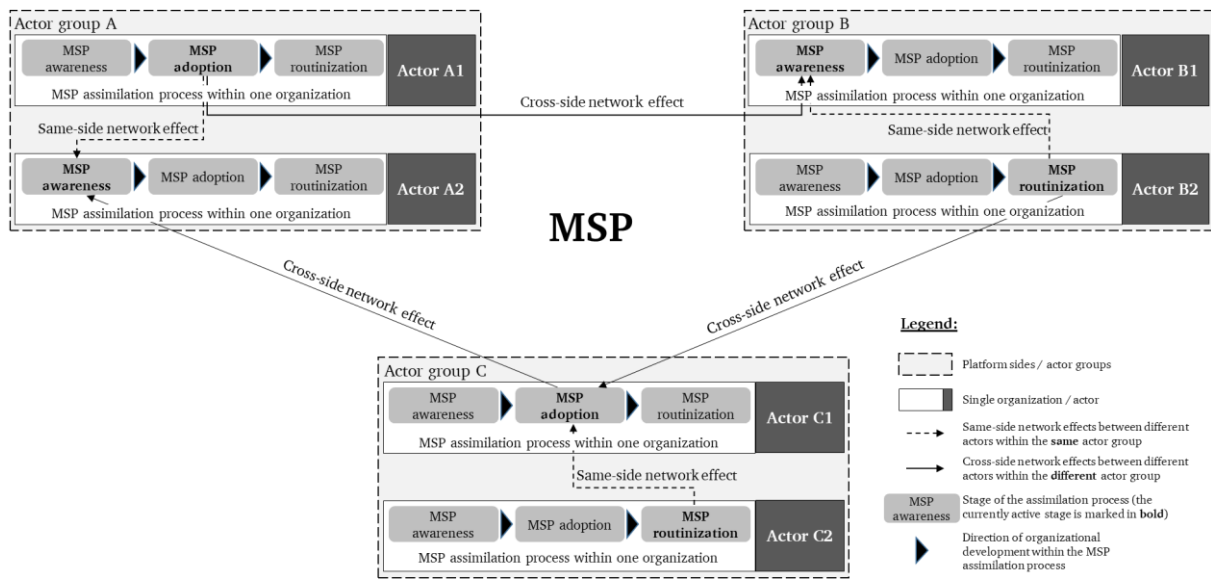


Figure 5: MSP diffusion process within dynamic B2B networks.

This detailed consideration is in line with Oliveira et al. (2014). They emphasize that influencing factors need to be considered as granularly as possible to understand the underlying mechanisms of the MSP diffusion process. The reasons for this are that organizations may be at different stages of the assimilation process, or that users' different personality traits may influence the process.

3 Factors Inhibiting the Diffusion of Multi-Sided Platforms

Title: Factors Inhibiting the Adoption of Cloud Community Systems in Dynamic B2B Networks: The Case of Air Cargo

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Abstract

While factors inhibiting information system (IS) adoption in the individual and organizational context are thoroughly investigated, research on the inter-organizational perspective remains widely disregarded. Recent studies reveal that cloud community systems (CCS) provide numerous benefits for organizations. However, in dynamic B2B networks high numbers of CCS fail, and thus, additional inhibitors of CCS adoption can be expected. We selected the air cargo hub in Frankfurt, Germany, as a suitable research case because of existing dynamics and an underutilized CCS. By using a grounded theory approach and the technological, organizational, and environmental (TOE) framework, we explored 21 factors inhibiting CCS adoption in dynamic B2B networks and categorized these into the TOE framework. Eight factors confirm existing literature. Caused by the specificities of dynamic B2B networks, we propose a re-categorization of six factors and a necessary extension of the TOE framework by the inter-organizational context (I) for the remaining seven new factors.

Keywords: IS Adoption, Cloud Community System, TOE Framework, B2B Networks, Airport Cargo Hub

3.1 Introduction

Information System (IS) adoption represents one of the most popular research topics in the IS area. For organizations, the adoption of new IS technologies offers a huge potential to enhance operative efficiency and competitive agility for long-term survival (Gupta et al. 2018; Molinillo and Japutra 2017). Especially cloud computing provides new opportunities for organizations to increase efficiency and flexibility at the same time (Benlian et al. 2018). In general, cloud computing means that resources are located in virtualized, geographically disperse datacenters, which can be accessed on an on-demand basis through web-based IS technologies (Bruque Camara et al. 2015; Hsu and Lin 2016). However, the benefits of this kind of IS technologies are only realizable if they are used (Petter et al. 2013). Therefore, IS adoption, which requires the decision to implement and use a new IS technology, is an important step to realize benefits from these technologies.

Although research on IS adoption is already very mature, there are still several research gaps that require further scrutiny. Existing research literature mainly concentrates either on users' individual or on the organizational IS adoption but not in the inter-organizational context (Gupta et al. 2018; Walther et al. 2018). Therefore, several researchers call for a wider and deeper investigation of the underlying mechanisms of the inter-organizational adoption of cloud-based IS, such like cloud community systems (CCS) (e.g., Gupta et al. 2018; Jede and Teuteberg 2016; Walther et al. 2018). This research gap is of special interest in the context of CCS because several organizations use the same IS infrastructure. A CCS consists of a cloud infrastructure, which is exclusively provided for a specific community or business to business (B2B) network with shared concerns (e.g., security requirements) (Mell and Grance 2011). Thus, CCS supports efficient inter-organizational cooperation. Besides this, factors that promote or inhibit the adoption of an IS between several organizations in a B2B network have been neglected so far (Borgman et al. 2013; Boukef Charki et al. 2011; Jede and Teuteberg 2016). Moreover, IS research often discuss advantages and opportunities instead of disadvantages, inhibitory influences or risks (Jede and Teuteberg 2016; Kembro et al. 2017). Additionally, various theoretical lenses, like the IS success model, often consider advantageous factors for explaining the adoption of an IS (Schäffer and Stelzer 2018). Although potential users report that they are aware of the benefits of an IS, they do not

adopt it. This raises the suspicion that unexplored inhibiting factors exist that lead to the non-adoption of an advantageous appearing IS. For these reasons and to comply with Jede and Teuteberg's (2016) call for research, we strive in this paper for inhibitors of the CCS adoption.

Examples for successful CCS adoptions can be found in e-commerce, retailing, automotive or chemical industries. In the chemical industry, actors of the B2B network successfully deploy a CCS called ELEMICA, where order and transport information are shared and stored in one system (Christiaanse and Sinnecker 2001; Son and Benbasat 2007). The chemical industry has strict requirements for such a system in terms of security, transparency, process quality, and integrity with a high amount of involved actors and interfaces. However, the adoption and the subsequent spread of the system were possible because of the governance structure of the producing organizations within the network (Christiaanse and Markus 2003). The so-called "lead-organization governed networks" are usually prevalent in buyer-supplier relationships but are not common in other B2B networks (Provan and Kenis 2008). Instead, the "shared-participant governed network" is the most common structure of B2B networks and often prevalent in dynamic networks, e.g., the transport sector. A main characteristic of dynamic B2B networks is a loose connection between interacting organizations. Moreover, no distinct hierarchy or governance by one organization exists, which can enforce the mandatory use of an IS technology. These networks are of considerable interest because CCS enables the lively cooperation between organizations within these networks.

Dynamic B2B networks can be determined by the structure and processes between organizations in a fast-changing environment with high uncertainty (Bhattacharya et al. 1998; Kutvonen et al. 2005). Structure in this context means that partnerships between multiple organizations in the network change frequently, and ad-hoc cooperation are common. This requires high flexibility and interoperability. The processes in dynamic B2B networks, especially in environments with high uncertainty, are usually characterized by continuous information updates and time-critical changes. These characteristics require real-time data provision and processing across actors, which can be enabled by CCS. In this context, other factors are likely to inhibit the adoption of CCS, which are not fully covered by the IS literature yet. For this purpose, we defined two research questions:

RQ 1) What factors inhibit the adoption of CCS in dynamic B2B networks?

RQ 2) Which of these inhibiting factors are new and thus extend the existing literature?

To answer these research questions, we selected the air cargo transport sector as a research context for dynamic B2B networks. Organizations in this sector are permanently faced with high time pressure and lately available transport information. Additionally, transport services are hard to differentiate, and margins are usually very low (Feng et al. 2015). This indicates the dramatically growing competition within the last years. Although the worldwide cargo volume is continuously increasing, air cargo faces a modal shift from air to sea (due to increasing process quality and decreasing transport times) and to land transport (due to new rail transport routes, e.g., the Silk Road between China and Europe) (Kupfer et al. 2017). Moreover, the competition between airport cargo hubs is becoming more intense. Therefore, a high need to improve performance in the air cargo business in general and at hubs, in particular, is pervasive to survive in this competitive and dynamic environment. Especially the landside pre-carriage of air cargo (from the sender to the airport) is characterized by high fragmentation due to the involvement of multiple actors (e.g., logistics service providers and various subcontractors) (Fung et al. 2005). The result is a decentralized network threatened by substitutability and high dynamics between involved actors. These specificities, as well as an underutilized CCS, are present at the airport in Frankfurt, Germany, which constitutes a particularly suited research case.

Firstly, by using a grounded theory approach (Corbin and Strauss 2015), we conducted several in-depth interviews and followed a systematic coding procedure. In doing so, different actors in the network (i.e., forwarders, truckers, and handling agents as well as system providers) and different positions (strategic and operative level) are interviewed to achieve a comprehensive list of inhibiting factors (RQ 1). Secondly, we categorized the identified factors based on the technological, organizational, and environmental (TOE) framework to discover existing and new factors (RQ 2). The contribution of our study is the necessary extension of the TOE framework with the specificities of the inter-organizational context. Moreover, based on the identified inhibiting factors, we generate deeper insights into why CCS are not adopted in dynamic B2B networks and thus enable practitioners to address inhibiting factors in an early stage and steer the adoption process.

The remainder of the paper is structured as follows. In the next section, the theoretical background with regard to dynamic B2B networks and CCS adoption is outlined. In section three, the research design, including the research case and methodology, is described in more detail. The results of our study are summarized in section four. Subsequently, the paper ends with the discussion of the results, the theoretical and practical implications, and gives a recommendation on further research.

3.2 Theoretical Background

3.2.1 Dynamic B2B Networks

In mature and established industry sectors, such as chemical industry or air cargo, competition and processes are already in place and prevent the fast spread of new shared IS technologies or infrastructures (Christiaanse and Sinnecker 2001; Son and Benbasat 2007). However, these shared IS technologies are highly valuable to facilitate inter-organizational communication and thus increase cooperation and process efficiency (Oliveira et al. 2014). An agreement and spread of IS technologies throughout a B2B network is challenging, especially in shared-participant governed networks, which are a common form of B2B networks in general (Provan and Kenis 2008). In reality, a large number of different organizations working together as equal partners lead to heterogeneous communication channels with a low degree of standardization (Boukef Charki et al. 2011; De Vries et al. 2003). Consequently, in an inter-organizational context and especially in shared-participant governed networks, a great effort for communication and coordination arises. In this context, IS technologies enable organizations to deal with a real and continuously changing environment (Bruque Camara et al. 2015).

Dynamic B2B networks are characterized by lively cooperation between loosely connected organizations in a fast-changing environment with high uncertainty (Bhattacharya et al. 1998; Kutvonen et al. 2005). We summarized the shared or deviating characteristics of conventional and dynamic B2B networks in Table 2. In contrast to conventional B2B networks, with most likely long-term business relationships, organizations in dynamic B2B networks work together with varying business partners. In these networks, margins are rather low, and similar products or services are provided by multiple organizations at a comparable service level. However, to differentiate and fulfill the demands, organizations have to offer a range of (full and partial) product- and service-related solutions. Especially for the requested partial

solutions, they might be reliant on information exchange with their competitors. This results in a quagmire where organizations cooperate and compete at the same time (Christ et al. 2017). Recent research deals with this quagmire called “co-opetition” (e.g., Mathias et al. 2017; Pitelis et al. 2017), whereby different organizational interests must be coordinated, resulting in highly complex dynamic B2B network structures.

Characteristics		Conventional B2B networks	Dynamic B2B networks
Structure	Governance structure	lead-organization governed or shared-participant governed	shared-participant governed
	Inter-organizational relationship	tightly / long-term	loosely / short-term
	Type of relationship	collaboration	co-opetition
	Type of products / services	complementary	substitutable or complementary
	Margin structure	high / medium	medium / low
	Speed of environmental changes	slow / medium	medium / fast
	Degree of uncertainty	medium	medium / high
Process	Process-related interdependencies	high	high
	Number of interfaces	medium / high	very high
	Time-criticality of information	high	very high
	Speed of order-related changes	high	very high
	Appropriate IS technologies	e.g., electronic data interchange (EDI)	e.g., cloud community systems (CCS)

Table 2: Characteristics of conventional and dynamic B2B networks.

The processes within these dynamic B2B networks are prone to continuous updates and most often require fast responses in order to keep the promised service level. In contrast to private or intra-organizational IS technologies, where a single person or the board of directors primarily decides on the adoption of IS, in dynamic B2B networks, this decision is influenced by and dependent on the behavior and action of other organizations. In accordance with Kutvonen et al. (2005), this requires a great amount of flexibility and agility of the participating organizations, which can be facilitated by an adequate IS infrastructure.

3.2.2 IS and CCS Adoption in Dynamic B2B Networks

In inter-organizational context scholars examine a granular assimilation process concerning the diffusion of technologies or standards between organizations. For instance, Gupta et al. (2018) define this granular assimilation process of IS as the spread across the intra-organizational processes, which covers three stages: first, the initial initiation or perception (awareness), second, the formal adoption and usage (adoption) and third, the final full-scale deployment (routinization) of an IS technology (Zhu et al.

2006b). This granular assimilation process is suitable for our case because IS assimilation between several organizations in a network is more complex compared to individual or intra-organizational IS adoption (Bruque Camara et al. 2015; Oliveira and Martins 2011). In line with Bruque Camara et al. (2015), we argue that the assimilation process depends on strategic as well as operative decision-makers. In early stages, like the transition from awareness to adoption, the top management primarily takes the decision for or against an IS technology and hence initiates the intra-organizational adoption. This is consistent with the findings of Jarvenpaa and Ives (1991), which states that the personal participation and use of organizational IS by Chief Executive Officers significantly influences the progressive use of IS by operative employees within an organization. However, in later stages like the transition from adoption to routinization, the degree of the IS adoption decision making shifts from the top management to the operative level. In these later stages, the involvement of the operative level is crucial because employees have to become familiar with the technology to accomplish their individual tasks and daily processes (Gupta et al. 2018; Wu and Chiu 2018).

In this paper, we consider the adoption of shared IS in dynamic B2B networks. CCS represent a technical solution for shared IS usage between several organizations. In more detail, CCS enable organizations to access shared data on an on-demand basis through web-based technologies (Bruque Camara et al. 2015; Hsu et al. 2015b). Thus, the shared and stored data is not located within organizations but in virtualized environments, which are geographically dispersed (Hsu and Lin 2016). In both research and practice, it is widely acknowledged that cloud systems can offer various benefits, such as cost savings and process improvements (Hsu and Lin 2016; Oliveira et al. 2014). In general, four types of cloud models can be differentiated: private, public, hybrid, and community clouds (our focus) (Goyal 2014). Whereas the private cloud is exclusively used by one organization or business unit, the public cloud is openly accessible and available to the general public. The hybrid cloud is a mixed type and consists of at least one public and one private cloud. In contrast, a community cloud shares the same services between several organizations on a jointly used and distributed infrastructure. They are designed for communities with common requirements, such as security or regulatory conditions. The ownership can be spread in the community as well as owned by one organization of the community or by a third party provider (El-Gazzar 2014; Gupta et al. 2018). The main purpose of the CCS is a custom-tailored data exchange between several

organizations via one system. Furthermore, CCS take the security protection goals, confidentiality, integrity and availability into account and provide each organization on-demand access to the authorized data, at any time and any place. Due to central data storage, redundancies are avoided and a consistent data pool can be achieved. CCS awareness, as the first step in the CCS assimilation process, exists already in most cases in the B2B sector. Hence, we focus on the adoption of a CCS (see Figure 6) including the transition from awareness and to routinization, in an inter-organizational context. We define the inter-organizational CCS adoption as making the strategic decision to try or use the CCS as well as the operative decisions based on the conduction of feasibility studies and user experiences in an area of tension between several organizations.

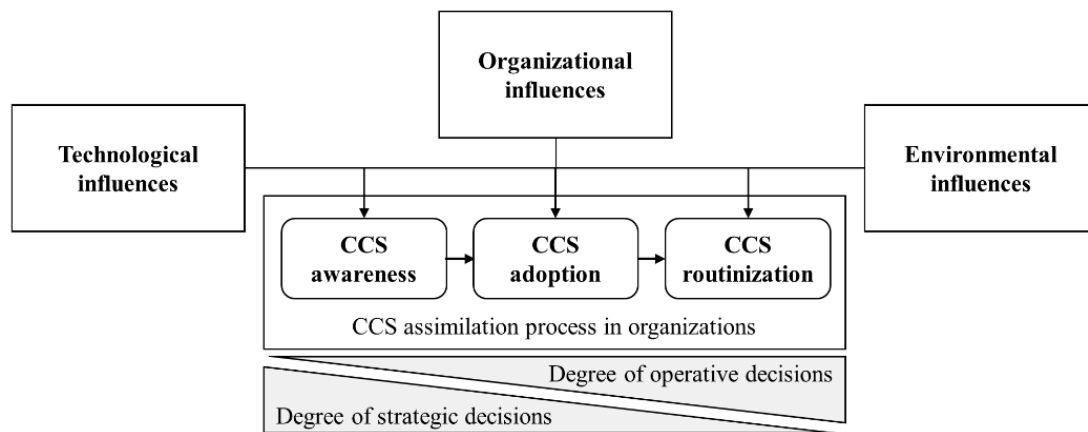


Figure 6: Relationship of the TOE framework and the CCS assimilation process.

The rare consideration of the inter-organizational context of B2B networks is a shortcoming in IS adoption research (Borgman et al. 2013; Bruque Camara et al. 2015; Hsu and Lin 2016). In particular, factors that inhibit the adoption of inter-organizational IS have been sparsely researched yet (Benlian et al. 2009; Jede and Teuteberg 2016; Schäffer and Stelzer 2018). Besides the investigation of factors influencing IS adoption in an inter-organizational environment (Bruque Camara et al. 2015; Hsu and Lin 2016), researchers demand validation and extension of existing theoretical models (Schäffer and Stelzer 2018). A frequently used theoretical approach is the TOE framework of Depietro et al. (1990). This framework identifies three contexts, which influence organizations' assimilation process: the technological, the organizational, and the environmental context (see Figure 6). The technological context is characterized by factors like a “lack of adequate information technology (IT) infrastructure (applications, databases, telecommunications) in the firm” (Teo et al. 2006, p. 398). The organizational

context contains descriptive characteristics of the firm, like measures about the size or the managerial structure. For example, Teo et al. (2006, p. 399) list factors such as “difficulties in making changes to existing organizational structure” or “difficulties in re-designing the business processes“. The environmental context deals with externally determined governmental or industry-specific requirements, e.g., “uncertain response of customers” or “complex legal issues” (Teo et al. 2006, p. 400).

However, the TOE framework is often only used to consider the adoption within one single organization or between two organizations (Borgman et al. 2013; Lee et al. 2015; Molinillo and Japutra 2017). For example, Lee et al. (2015) investigated the adoption of electronic data interchange (EDI) between two companies. The direct data exchange between two companies is not comparable with the data exchange within a dynamic B2B network. Usually, EDI interfaces are created between two companies that cooperate on a long-term basis and follow in a continuous sequence in the supply chain (e.g., the raw material supplier implements an interface to the following producer of the intermediate product but not to the producer of the final product) (Markus et al. 2006). In contrast, dynamic B2B networks are characterized by co-opetition as well as short-term and ad hoc relationships with often new and varying business partners. Due to these characteristics, the number of interfaces is increasing accordingly. This is an important distinction to conventional networks. In conventional networks, the number of interfaces is nearly constant, with $n*(n-1)/2$ for n actors. Furthermore, accompanied with an increasing number of actors and interfaces, the heterogeneity of the interfaces rises, which leads to higher complexity and increases maintenance requirements. Therefore, EDI as technology, as well as the existing research on EDI adoption, are not sufficient for the explanation of the data exchange in dynamic B2B networks. This is in line with the calls for research from Schäffer and Stelzer (2018), Hsu and Lin (2016), Bruque Camara et al. (2015), and Borgman et al. (2013). They claim for more qualitative studies regarding factors influencing the adoption of cloud systems and refer to the TOE framework as a suitable basis. In sum, the factors derived from the existing literature cannot sufficiently explain CCS adoption in dynamic B2B networks.

3.3 Research Design

3.3.1 Research Case: The Air Cargo Hub in Frankfurt, Germany

The air cargo sector is characterized by high fragmentation, strong competitive pressure between several organizations as well as highly dynamic nature. Moreover, the continuously increasing transport volume amplifies the need for efficient processes (Kupfer et al. 2017). However, for flexible and efficient cargo processing, the cooperation between several loosely connected organizations is required. In sum, the air cargo sector matches the characteristics of a dynamic B2B network and thus represents an ideal field for our investigation. Especially the air cargo hub in Frankfurt, Germany is a highly dynamic B2B network with more than 250 logistics companies and over 2 million tons of cargo in 2016, which makes it the biggest cargo handling airport in Europe and one of the top ten worldwide (Airport Council International 2016; Fraport AG 2016). In 2008, the community decided to implement a CCS at the hub. The aim was to improve process efficiency and quality standards as well as to reduce throughput time enabled by the cloud, where all actors have electronic access to the relevant transport information. Therefore, an established provider (successfully operating a CCS at a seaport) was chosen to drive the implementation. In 2018, ten years later, the system is still far away from being a standard. By now, around 20 % of the actors at the hub have an interface to the CCS, and the usage rate (10-30 % of the transport volume, actor-dependent) is still very low.

In general, an air cargo network consists of various actors from the sender (origin) and various logistics service providers (e.g., forwarders, truckers, handling agents) in the pre-carriage, the carrier (airline) in the main-carriage and further logistics service providers in the on-carriage to the receiver (destination) (Kupfer et al. 2017). One of the major challenges hereby is to coordinate several interdependent activities within the physical flow of goods as well as the information flow between the involved actors (Davidsson et al. 2005). Reasons for the lack of effective and efficient information connectivity are, i.e., the low margins within the sector and the high dynamics between varying organizations (Harris et al. 2015). Air cargo is mainly chosen for valuable, dangerous, or time-sensitive goods (Feng et al. 2015). Despite that, for 78 % of the transport time, air cargo is waiting at the airport for transport, mainly due to the lack of communication between actors (Harris et al. 2015). This highlights the need for more efficient processes.

Taking a closer look at the air cargo process flows, a sender (e.g., manufacturer or retailer) initiates and assigns a transport order to a forwarder, who usually coordinates the transport network in the air cargo business (Forster and Regan 2003). The forwarder requests transport capacity from airlines and truckers. In the pre-carriage, the trucker transports the booked cargo from the sender to the forwarder's consolidation hub. The consolidation hub can be located either close to specific senders or directly at the airport cargo hub. The forwarder consolidates cargo (with an optimal weight volume mix) on the air cargo pallet. Then again, a trucker transports the pallets and further loose cargo to the handling agent (with direct access to the apron where the airplanes are loaded) (Feng et al. 2015). Loose cargo is especially interesting because hereby, the handling agent is dependent on early information for optimal pallet consolidation on their site. The relationship between these actors is illustrated in Figure 7.

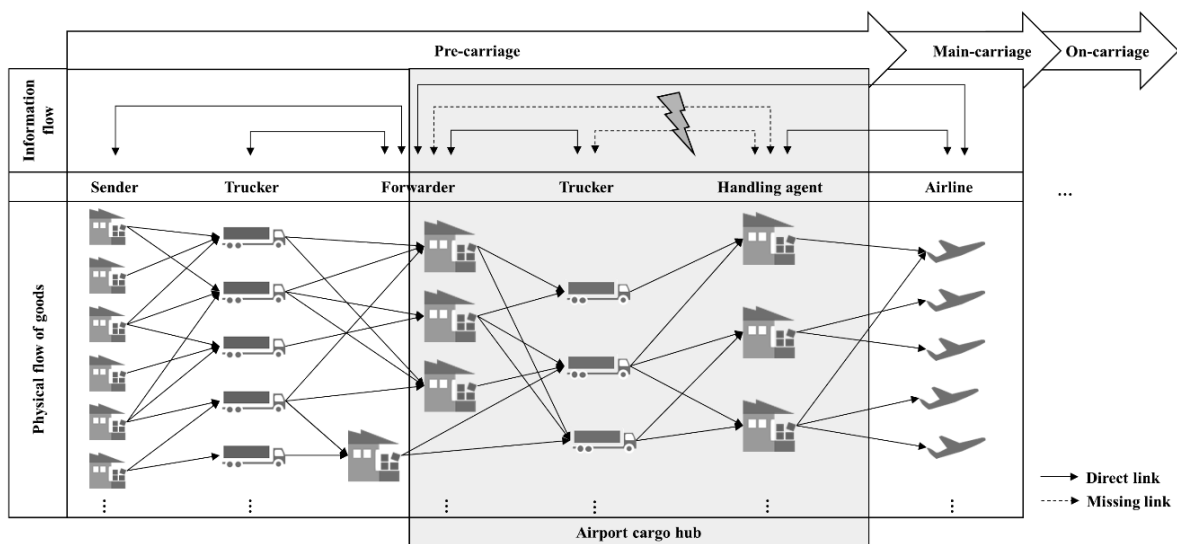


Figure 7: Actor relationships in an air cargo transport network.

Important to mention is the missing link in the information flow between forwarders, truckers, and handling agents, which is mainly caused by the contractual relationship. The handling agent is contracted by the airline and the trucker by the forwarder. As a consequence, no direct interface to share information between the forwarder or trucker and the handling agent exists. However, because of the direct linkage in the physical flow of goods, these actors should benefit the most from early information exchange (e.g., estimated time of arrival) to reduce uncertainty and improve processes (Naim et al. 2006).

In fact, most of the time, the forwarder enters the relevant transport order information into their proprietary system because a high number of senders still transmit the transport orders manually via phone, fax, or e-mail (Elbert et al. 2017). Thus, the forwarder is the first one in the network where all necessary transport information is electronically available. Additionally, the order information is intentionally held back by the forwarder until order information from the sender becomes more precise concerning, e.g., cargo weight to optimize their own weight-volume consolidation mix on the pallets. This illustrates the overlapping competencies or co-opetition of actors. The trucker suffers from the missing information flow because of high waiting times before loading and unloading at the ramp of the forwarder or the handling agent. The handling agent receives information only via the airline but not directly from the forwarder. In sum, this delayed information flow interferes with forecasting and planning activities and causes high waiting times and inefficient resource utilization within the network. These inefficiencies substantiate the need for and the expected added value of a CCS. However, the low adoption rate after ten years cannot prove the theoretical value of the system, and the question is why the system remains under-utilized.

3.3.2 Research Methodology

To discover the inhibiting factors influencing the adoption of a CCS in a specific community, we adopted the principles of grounded theory. Grounded theory, developed by Glaser and Strauss in 1967, is a qualitative methodology suitable to explore an area not yet thoroughly researched and to inductively build theory grounded in data (Corbin and Strauss 2015). Besides, this approach is particularly suitable for exploring new factors (Lawrence and Tar 2013). Therefore, this methodical approach is ideally suited to examine our research questions. The data in this study is primarily gathered in face-to-face interviews, an adequate technique for exploratory research because it allows expansive discussions of various factors (Yin 2017). For the identification of the relevant actor groups, we used the stakeholder theory (De Vries et al. 2003). In doing so, we selected four actor groups (handling agent, trucker, forwarder, and software provider) and for each actor group two different hierarchical levels (strategic and operative). The distinction between strategic and operative employees is often fluent. In accordance with Paavola et al. (2017), strategic employees mean top and middle management with a budget and personnel responsibility (usually more than ten employees) as well as highly strategic or project orientation. In contrast, operative employees cover middle

management highly involved in daily business and workers with daily interaction with workers of other actor groups. Based on this, we defined the case setting and developed interview guidelines consisting of four theme blocks: firstly, the as-is situation (e.g., analogous vs. electronic information flow) and their knowledge and application of CCS; secondly, the evaluation of CCS; thirdly, further possible challenges and barriers of CCS; and fourthly, expectations of a to-be situation. For instance, we asked “Why are you (not) using the CCS?“, “What challenges are you facing when using the CCS?” or “What are possible barriers for you with regard to the CCS?”. We verified our guidelines in a pre-test with three other researchers who were not involved in the design phase. Through the chosen wording, the open-ended questions and by interviewing individuals at different hierarchical levels, we reduced response and interviewee biases.

Additionally, the interview data were supplemented by documents (process documentation, marketing brochures, usage and error statistics, etc.) provided by the interviewees and system providers. The supplemented documents serve as background information and are not included in the systematic coding procedure. Our data, which primarily consists of the extensive interview transcripts, is analyzed by means of a process termed constant comparison (Corbin and Strauss 2015). In this inductive, case-oriented, iterative process the data collection procedure is continuously adapted to the prior discovered findings (inter-relationship between data collection and analysis), which means that data gathering is accompanied by data analysis until the researchers achieve saturation and no further findings are expected (Corbin and Strauss 2015). Once a new code or factor was identified, these new findings were taken into account in the next interviews and validated by indirect questions. In line with Beattie et al. (2004) we define our termination criterion as follows: stop executing further interviews when no additional codes are needed. This means that all statements in the transcript can be assigned to the prior developed coding.

For our data analysis, we applied a systematic coding procedure with three types of coding: open, axial, and selective coding (Batra et al. 2017; Beattie et al. 2004; Mathias et al. 2017). In the initial phase, open coding was used to reveal the main ideas in each transcript and break down the gathered data line-by-line. The target of the open coding analysis is the production of codes, which is the first order coding that relates directly to the data. To ensure a common understanding of the emerging codes in this iterative

procedure, we determined Cohen's kappa (k) as an indicator of agreement between researchers by coding the same transcript sections for randomly selected subsets. The commonly accepted threshold is above $k=0.70$ (Krippendorff 2004), and we surpassed this in all tested subsets.

The second-order coding, axial coding, was used to summarize the data in a relational form into categories, which in this case, represent the inhibiting factors. Once a factor was determined, the focus returned back to the data as a deductive procedure to question the validity of the factors (Mathias et al. 2017). For instance, we recognized numerous statements in the transcripts about the inter-organizational process comprehension, e.g., missing knowledge of the processes of other actor groups or the realized complexity to streamline the processes between actor groups. These and other codes are condensed into the factor *external processes*.

The third and last form of coding, selective coding, involved the process of systematically relating the factors to a higher level of abstract generality (overarching themes). These overarching themes are primarily developed in systematic discussions between the researcher team as well as a structured review of existing factors and themes in related literature (e.g., Kembro et al. 2017). In sum, the overarching themes reflect the actor-neutral dimensions independent of the perspective and belonging to a specific actor group. An example is the overarching theme *process*, which includes the factors *internal and external processes* as well as the factor *process dynamics*. The evolving list of codes, factors, and themes were thoroughly discussed with researchers and professionals to confirm and ensure validity and objectivity.

We achieved our termination criterion after the ninth interview (no. 4 in Table 3) because, in the tenth interview, no further codes were added. We conducted one additional interview (no. 11) to confirm that the termination criterion was achieved. Moreover, we conducted four additional interviews (no. 12 – 15) with system providers. One of them is the dedicated CCS provider, including additional modules and software applications for organizations at the cargo hub. The others are the corresponding competitors. These four interviews with providers serve to validate our results and not to develop further codes because they have experience with all relevant actor groups. In total, from August 2017 until January 2018, we conducted 15 interviews, with more than 20 experts, distributed across all identified actor groups. Table 3 contains the

conducted interviews (sorted chronologically within actor groups), the position of interviewees as well as the duration of the interviews. The number (no.) within the table is not related to the anonymized quotations (Interview#) in the results. To achieve high external validity with a representative sample, we selected organizations and interviewees with respect to appropriate distribution of actor groups, organizational or company focus, as well as hierarchical levels (from strategic management to service clerks and dispatchers). All 15 interviews are audio-recorded and transcribed, resulting in roughly 300 pages. In addition, thoughts and ideas that emerged during an interview were documented within or directly after each interview. Any inconsistencies that emerged in the transcription process were resolved in discussions among the authors. As recommended, each interview was analyzed directly after it had been finished to guide the next interview. The data analysis was conducted by using the software MaxQDA, which is widely used for qualitative research evaluation (for an overview of tools, see Kuckartz (2014)).

No.	Actor Group	Position	Hierarchy Level	# Inter-viewees	Length	Codes added?
1	Handling Agent	Employee Customer Service / Warehouse	Operative	2	1:39	Yes
2	Handling Agent	Employee Customer Service	Operative	1	0:49	Yes
3	Handling Agent	Key initiator of CCS implementation group / Customer Service Manager	Strategic	2	1:33	Yes
4	Handling Agent	Managing Director	Strategic	1	0:52	No
5	Trucker	Employee Dispatcher and Transport	Operative	1	1:03	Yes
6	Trucker	Managing Director	Strategic	1	1:35	Yes
7	Forwarder	Import and Export clerk	Operative	1	1:25	Yes
8	Forwarder	Senior Vice President	Strategic	1	1:23	Yes
9	Forwarder	Site Director	Strategic	1	1:41	Yes
10	Forwarder	Employee Import, Export and Warehouse	Operative	3	1:36	Yes
11	Forwarder	Vice President	Strategic	1	1:22	No
12	Provider	Vice President Trade Solutions	Strategic	1	1:19	-
13	Provider	Senior Managers Communication Services	Strategic	2	1:14	-
14	Provider	Business Partnership Manager / Implementation Consultant	Operative	2	1:29	-
15	Provider	Managing Director	Strategic	1	1:37	-

Table 3: Interview participants and duration of interviews.

3.4 Results

To answer our first research question, “What factors inhibit the adoption of CCS in dynamic B2B networks?” we applied the grounded theory approach. In doing so, we identified 56 codes in the first order coding (see Figure 8). As an example, the code 2a, *missing implementation of local needs and specifications*, evolved by quotes like “There can’t be one global solution; local requirements must be mapped in the system.” (Interview#08 2017) or “The solution must be local. You can’t solve this worldwide. You have different requirements all over the world at every airport, different contracts, different systems, different actors, [...]” (Interview#09 2017). Afterward, we followed the systematic procedure of the axial second-order coding and continuous validation process with scientific and practical experts. We derived 21 factors, which represent the inhibitors of CCS adoption. Furthermore, we aggregated these 21 factors into six overarching themes: technical requirements, mindset, characteristics of system provider, regulations, competition as well as process. On the one hand, we were able to derive our themes from the existing, conventional B2B network literature (e.g., Kembro et al. 2017). On the other hand, we build on this existing literature and derived additional

themes in systematic discussions between researchers. A comprehensive overview of the identified factors, including the corresponding codes and the overarching themes is presented in Figure 8.

To distinguish whether the inhibitory effect of the factor is considered more by strategic or more by operative interviewees, we have determined a ratio (r). The ratio based on more than 700 different quotations from 11 interviews with handling agents, truckers, and forwarders (excluding system provider). We calculate the ratio by dividing the number of (#) strategic quotes of one factor (i) by the total number of quotes for this inhibiting factor (both strategic plus operative quotes). We highlight the ratios in Figure 8, too. A ratio higher than 0.5 indicates that strategic interviewees mostly mentioned this factor. By contrast, a ratio of less than 0.5 means that this factor was mostly mentioned by operative interviewees. Furthermore, a ratio of exactly 0.5 means that both strategic and operative interviewees considered this factor equally important. Formally, a factor (i) is represented by the tuple ($\#StrategicQuotes$, $\#OperativeQuotes$) and function r maps to the closed interval between 0 and 1:

$$r(i) = \frac{\#StrategicQuotes_i}{\#StrategicQuotes_i + \#OperativeQuotes_i} \quad \forall i \in F$$

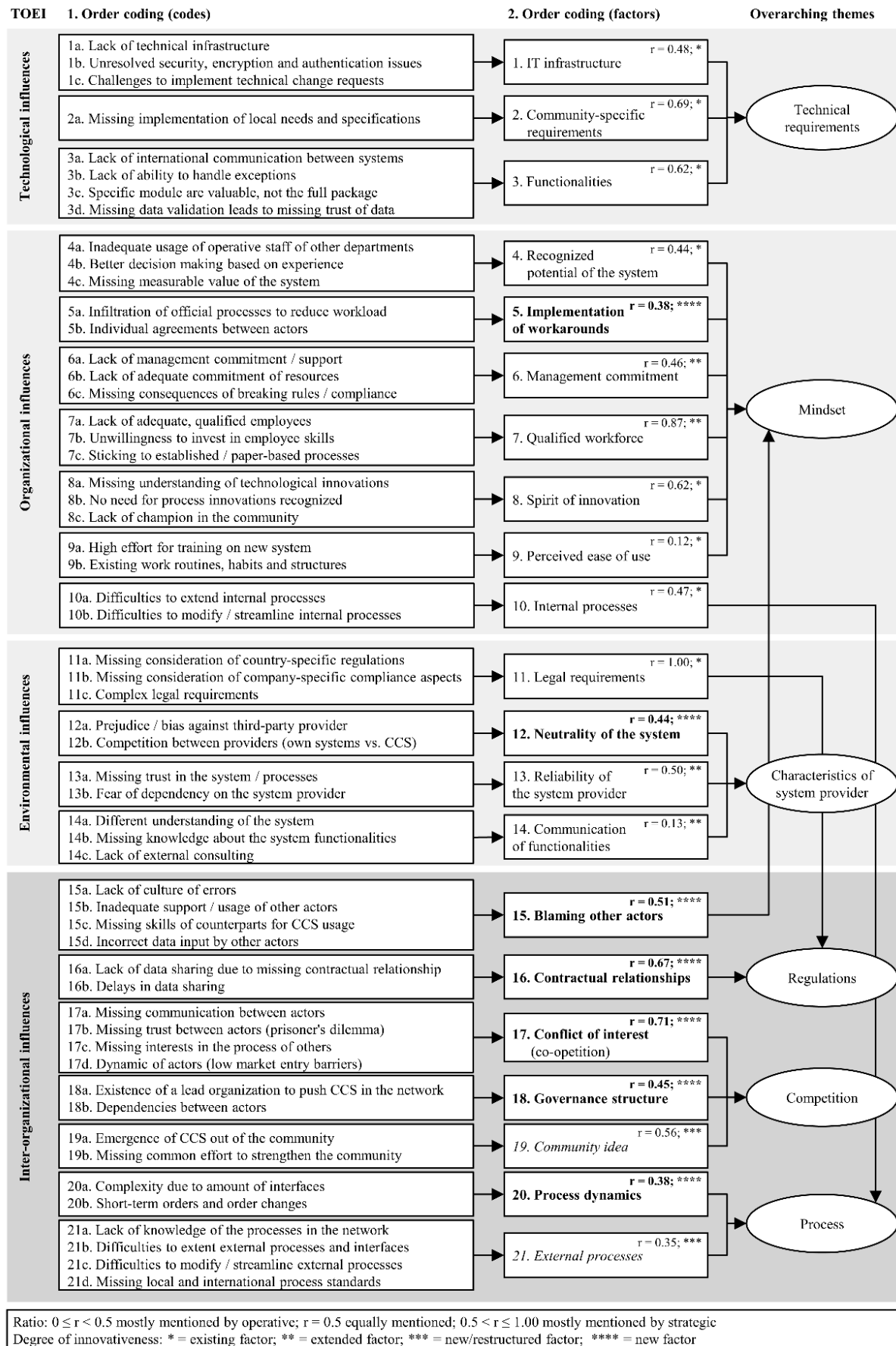


Figure 8: Comprehensive overview of all identified factors with TOEI classification.

To answer our second research question, “*Which of these inhibiting factors are new and thus extend the existing literature?*”, we assigned our 21 factors to the TOE framework. During this procedure, it turned out that the existing framework is not sufficient in an inter-organizational context. We identified factors, for instance, resulting from conflicts of interest between two or more organizations. These factors cannot be assigned to the existing contexts of the framework. With regard to the increasing inter-organizational collaboration between organizations (Hsu and Lin 2016), we propose an extension of the framework. For that reason, we extended the TOE framework by the inter-organizational context, abbreviated with “I”. This context deals with aspects arising from dynamics in B2B networks. Hence, the effects associated with the conflict between cooperation and competition are taken into account. In order to assess which of these factors are completely new and which confirm the existing literature, we determined the factors’ degree of innovativeness. This degree classifies the factors into existing, extended, new/restructured, and new factors in comparison with the existing literature. Out of the 21 factors, eight are existing in the literature (in Figure 8 marked with: *). Seven are partially consistent with the literature, and we extended these factors with additional codes (marked with: **). So far, our TOEI assignment of the codes corresponds with the TOE assignment in literature. Furthermore, we identified two factors, which already exist in the literature, but due to the inter-organizational context, a reassignment in the TOEI context was needed. We named these new/restructured factors (marked with *** and italic). Subsequently, we could not identify the remaining seven factors in the literature, so these factors are new inhibitors for CCS adoption (marked with **** and bold). Table 4 contains definitions and explanatory quotations of the seven new inhibitors for CCS adoption.

Factor	Definition	Quotation
Implement- ation of workarounds (No. 5)	Actions or agreements of actors, which infiltrate the CCS usage or general defined processes to achieve short-term benefits (on employee or organizational level).	“We have other options, special arrangements with the [other actor] that’s how it works. This is not compatible with the CCS. If we integrate the CCS, we have to drop the special arrangements, which are working well.” (Interview#14 2017).
Neutrality of the system (No. 12)	Aspects considering the independent competitive market position of the CCS provider in relation to other providers in the community.	“The profit orientation of the provider is a problem. My approach would be that the CCS should be provided by an independent non-profit provider.” (Interview#01 2017).
Blaming other actors (No. 15)	Statements and actions aimed at justifying that the non-adoption is caused by other actors.	“That’s terrifying. [...] some actors work with software, which is almost 30 years old and thus cannot connect to the CCS. They are not doing their homework [...].” (Interview#08 2017).
Contractual relationships (No. 16)	Barriers, which are attributable to the contractual relationship between actors.	“The irony is that they [actor without contractual relationship] doesn’t give us the data via the CCS because of liability issues. It’s ridiculous because I receive the data later on in hard copy anyway.” (Interview#08 2017).
Conflict of interest (No. 17)	Attitudes and characteristics, which result from the different interests of the actors, positioned within area of tension between cooperation and competition (co-opetition).	“There is no willingness to use it and adapt the processes because there are various conflicts of interest. [...] In fact, the market situation does not make it easy for us.” (Interview#09 2017).
Governance structure (No. 18)	Actions which can only be conducted by organizations in a leading position within the network due to their assertiveness.	“Without governance, there won’t be only one location wide common system. If the solution is to use one common CCS, then a local player, for example the airport operator, is needed to dictate its use.” (Interview#15 2017).
Process dynamics (No. 20)	Statements regarding the requirements and attributes of the processes, which are characterized by high dynamics within the transport processes.	“It’s rooted in short-term changes of the time sensitive transport. Until I processed or changed all information in the CCS, the transport is already delayed. Thus, I just sort the paperwork without the system.” (Interview#03 2017).

Table 4: Definition of the seven new factors with corresponding quotations.

In the following, we exemplarily introduce our suggested allocation of the new factors to the extended TOEI framework. For example, workarounds are often used within an organization. Thus, we assigned this factor to the organizational context. We choose *mindset* as a suitable overarching theme because workarounds aim to generate individual advantages, which correspond to the defined opportunistic behavior. We assigned the factor *neutrality of the system* to the overarching theme *characteristics of system provider* and placed the factor into the environmental context of the TOEI framework. The system provider is an external company, not directly a part of the community, and therefore the environmental context is suitable.

Even more interesting are the factors assigned to our new inter-organizational context. For instance, the factor *blaming other actors* is one of the most voiced factors (in sum, more than 80 quotes). In dynamic B2B networks, especially when shared goals and co-opetition exists, organizations (as well as individuals) often try to blame someone else for a failure or mistake. Especially when many different actors work together, processes or responsibilities change quickly. Thus, to backtrack the origin of a mistake is very complex. Additionally, nobody wants to admit self-inflicted errors in the network. This illustrates that, in general, blaming is an individual attitude. Therefore, the overarching theme *mindset* is suitable. Besides our seven new factors, we identified two factors that require special consideration. The factors, *community idea*, and *external processes* exist both partly in literature. On the one hand, we identified additional codes, which do not exist in the related literature (see Figure 9; highlighted with (no)). On the other hand, we identified codes that do not fit in the former TOE context by looking at dynamic B2B networks.

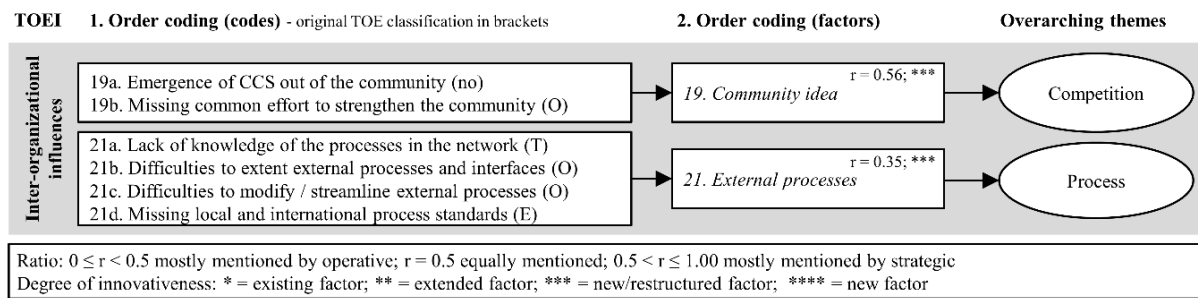


Figure 9: New/restructured factors within the inter-organizational context.

We define our 19th factor, *community idea*, as requirements, tasks, and goals, which the community should perform and accomplish with regard to CCS implementation (which might contradict organizational goals). The code 19b, *missing common effort to strengthen the community*, could be found in the existing literature, e.g., Teo et al. (2006) within the organizational context (O). Instead, our code 19a, *emergence of CCS out of the community*, cannot be found in the literature. In our results, both codes are often named as inhibitors for CCS adoption. Mostly, the strategic interviewees mentioned these inhibitors. Our code 19a states that CCS should evolve out of the community with high importance of commitment towards the system. Additionally, interviewees in B2B networks highlight the premise for collaboration: “If we all work together, then we would

be much better off. There's enough cargo on the market” (Interview#04 2017). Therefore, we have assigned this factor to the overarching theme competition.

The 21st factor, *external processes*, covers four codes, mostly mentioned by operative interviewees. We assign this factor to the overarching theme process. This factor summarizes statements and opinions regarding overarching inter-organizational processes, which cannot be adjusted by one organization independently. Additionally, in this context, the codes 21a, *lack of knowledge of the processes in the network* and 21c, *difficulties to modify / streamline external processes*, emerged. The code 21a cannot be classified in the technological context. Statements such as *“That's the scary thing about airfreight that the involved people really only know their own area and their own interfaces and do not realize how a CCS can support the overarching processes. For example, they don't know or care about, how we handle freight [...]” (Interview#06 2017)* show that a lack of process knowledge between organizations is a huge inhibitor. In our opinion, this is a lack of inter-organizational and not a technological context, and thus, the factor requires re-classification. This goes hand in hand with code 21d, *missing local and international process standards*. Some actors argue: *“It would be important for its dissemination to be recognized as a standard for the hub. It [the use of the CCS] should be as simple as possible for them [organizations]. If the same delivery process applies everywhere, it's easier for everybody” (Interview#05 2017).*

Factors like the lack of ability of users to use the IS, the fear of losing their job due to the IS adoption, or the higher transparency caused by the IS are often listed as inhibiting factors for adoption in the IS literature (Benbasat and Barki 2007). Therefore, we explicitly mentioned these factors in the interviews, but in our case, interviewees neglected these factors. Neither the strategic (regarding the company's existence) nor the operative (regarding the job threat) interviewees see any danger from the CCS and, therefore, no reason to inhibit the adoption. The increasing transparency through CCS usage was also not seen as a threat.

3.5 Discussion

In this study, we posed two research questions: (1) “What factors inhibit the adoption of CCS in dynamic B2B networks?” and (2) “Which of these inhibiting factors are new and thus extend the existing literature?”. The existing body of research regarding the CCS adoption in dynamic B2B networks is not sufficient for the investigation of our research

questions. Research in recent years has neglected the inter-organizational context of dynamic B2B networks (Gupta et al. 2018; Walther et al. 2018). In order to counteract the resulting research gap, we used a grounded theory approach and conducted 15 interviews with strategic and operative employees. We chose the Frankfurt air cargo hub as a research case because the air cargo sector represents a dynamic B2B network with a high amount of actors. Furthermore, due to fragmented tasks within the transport network, the actors compete and cooperate at the same time (co-opetition). We used a systematic coding procedure with open, axial, and selective coding. In doing so, we analyzed more than 20.5 hours of interview data and developed 21 factors inhibiting CCS adoption (RQ 1). The exploration of factors inhibiting the adoption of CCS in dynamic B2B networks is another key characteristic of this study. IS research often discusses advantages or possibilities, such as factors promoting an IS adoption (Jede and Teuteberg 2016; Kembro et al. 2017). However, factors inhibiting IS adoption are also of central importance because they can explain why an advantageous appearing IS is not adapted. Therefore, a growing number of scholars recently called for a wider and deeper investigation of inhibitors of IS adoption (Borgman et al. 2013; Jede and Teuteberg 2016; Schäffer and Stelzer 2018).

Compared to individual IS adoption research, research on inter-organizational IS adoption is embryonic, and it is important to validate or extend existing theoretical models (Schäffer and Stelzer 2018). Hence, we build on a frequently used theoretical framework, the TOE framework of Depietro et al. (1990). In doing so, we demonstrated that our 21 inhibiting factors could not be fully assigned to the three existing contexts (technological, organizational, and environmental). Consequently, we extended the TOE framework with the context I (inter-organizational) which constitutes a necessary extension due to the increasing interaction of organizations in dynamic B2B networks. Figure 10 illustrates the new TOEI framework as well as the effects on the CCS adoption.

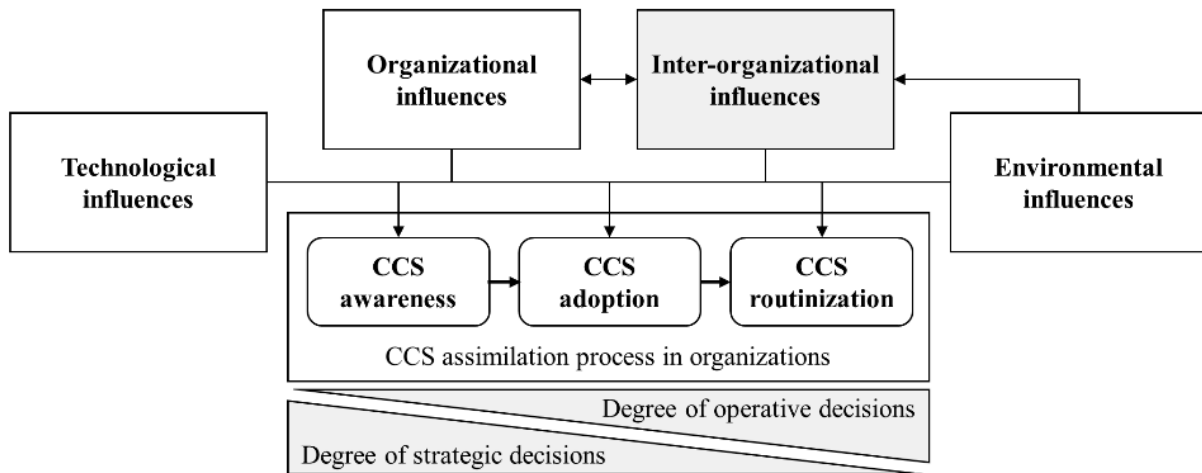


Figure 10: New TOEI framework: Proposed extension of the TOE framework.

In sum, we identified seven new, two new/restructured, four extended, and eight existing factors inhibiting the adoption of CCS in dynamic B2B networks (RQ 2). In more detail, five of the new factors are assigned to the inter-organizational context. One is assigned to the organizational context and one to the environmental context. In addition, we restructured two existing factors into the new inter-organizational context. Beyond this, we extended four factors with additional codes and confirmed eight factors from established literature. However, an overlapping meaning of some of the factors and contexts cannot be excluded. For instance, the factor *governance structure* from the inter-organizational context is comparable to the factor *management commitment* in the organizational context because both refer to a leading position of one organization (within a network) or the management (within an organization). In dynamic B2B networks, the *governance structure* will be an additional decisive factor because in a shared-participant governed network, there is no lead-organization who can enforce the network-wide use of one system.

With regard to the ratio, the factor *external processes* revealed an interesting insight. The fact that operative interviewees mentioned this factor more often was surprising because we expected the inter-organizational perspective and opinions more from strategic interviewees. This insight strengthens our assumption that it is necessary to consider strategic and operative perspectives for CCS adoption in dynamic B2B networks.

3.5.1 Implications for Research and Practice

Our study has several implications for research and practice and contributes strongly to the sparse existing research body of IS adoption in dynamic B2B networks. We

demonstrated that the existing TOE framework does not cover important factors resulting from inter-organizational demands. Therefore, we developed a proposal for the extension of the framework. In doing so, we contribute to Schäffer and Stelzer (2018) call for research. We propose an extension of the TOE framework, which takes into account the specific requirements for the CCS adoption in dynamic B2B networks. This extended framework can be used as a basis for further research in the inter-organizational context. Due to the conscious abstract formulation, the framework can be adopted to other objects of investigation. Furthermore, we discovered seven new factors that inhibit the adoption of CCS in B2B networks. These seven new inhibiting factors are of considerable interest for two reasons. First, we contribute to a more critical consideration of IS research by analyzing factors inhibiting IS adoption. In addition, this stands in contrast to the often existing analysis of advantages, opportunities, and promoters of IS adoption and is explicitly requested by Jede and Teuteberg (2016) and Kembro et al. (2017). By doing so, we provide new stimuli to extent the common perspectives of the existing IS research and broaden the theoretical lenses. Second, these factors provide new insights into the adoption process in the inter-organizational context. Especially the factors resulting from the tension between different organizations offer a new perspective on the adoption process. Due to the necessary reclassification of the two factors, we extended the existing literature. By confirming eight existing factors, we strengthen their existing predictive power. Furthermore, we show that their existence in the context of CCS and hence, extended their universal validity. Finally, we pointed out that the CCS adoption decision in an inter-organizational context is influenced by strategic and operative employees. The quantification of these different influences should be considered in further studies.

Besides our theoretical contributions, we revealed important insights for practitioners. The implementation of CCS provides multiple benefits for B2B networks. However, CCS adoption requires the adjustment of processes and routines of employees, and thus failure is costly for organizations. To prevent failures of CCS adoption, practitioners should address the identified factors in the implementation phase in order to steer the adoption and the overall assimilation process. Especially for dynamic B2B networks, it is valuable to understand underlying factors inhibiting CCS adoption. The extended framework enables actors to detect inhibitors and take countermeasures to foster the spread throughout the organization on the strategic and operative level and subsequently

throughout the network. Additionally, the extended TOEI framework and the assigned factors enable a better understanding between related actors and thus of the entire network.

3.5.2 Limitations and Further Research

Firstly, our results are limited by the selected case. Indeed we selected the biggest airport cargo hub in Europe, but other locations might reveal other factors. Secondly, it is conceivable that managers could also take operative views into account and vice versa. Therefore no strict separation between quotes is possible (no black and white thinking). This could influence the calculated ratio and the categorization of the factors regarding the hierarchy level, which should be verified in follow up studies. Thirdly, our findings are based on a grounded theory approach. To prove and further determine the degree of influence, the factors should be evaluated quantitatively by the interviewees in a next step. Further research is needed to prove our findings in large scale studies. Additionally, to generalize the results further investigation regarding other industry sectors, other countries or cultural differences should be conducted. Furthermore, the assimilation of IS can be influenced (positively as well as negatively) by network effects. This should be considered in the future for the identified factors. In sum, our study represents an important first step towards a better understanding of factors inhibiting CCS adoption and may, therefore, serve as a springboard for future research to examine the underlying mechanism of the CCS adoption in the inter-organizational context.

3.5.3 Acknowledgement

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4 The Impact of Inhibitors on Network Effects

Title: Multi-sided platform diffusion in competitive B2B networks: Inhibiting factors and their impact on network effects

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Abstract

Although multi-sided platforms (MSPs) and their diffusion in B2C contexts received heightened attention in recent literature, there is still a dearth of research on MSP diffusion inhibitors in competitive B2B networks. Using the air cargo hub in Frankfurt, Germany, as a highly competitive B2B network that struggles with the acceptance of an MSP for over ten years, we applied a grounded theory approach to identify key inhibitors to MSP diffusion. Based on several interviews with a diverse set of stakeholders and a systematic coding procedure, we identified 21 factors inhibiting MSP diffusion. The majority of these factors slow down or even thwarts positive network effects, typically occurring on MSPs. Furthermore, we derive a classification showing that the inhibiting factors primarily hamper cross-side network effects in highly competitive B2B networks, and to a lesser degree, also same-side and mixed-side network effects. Finally, the implications of these results and future research directions are discussed.

Keywords: Multi-sided platform, diffusion, inhibiting factors, network effects, case study, air cargo

4.1 Introduction

Multi-sided platforms (MSPs) have tremendously increased in popularity over the last decade (Hagiu and Wright 2015; Wan et al. 2017). In general, MSPs constitute an electronic marketplace that enables interaction between two or more groups of actors mediated by a platform provider, where the decisions of a group on one side affect the outcomes of the group(s) on the other side(s) (Hagiu and Wright 2015; Rysman 2009). According to Hagiu and Wright (2015), MSPs are characterized by two main attributes: First, MSPs enable direct interaction between two or more independent groups, each consisting of multiple users or organizations. Second, each group is connected to the platform. For organizations, MSPs provide new opportunities to increase efficiency and flexibility at the same time (Benlian et al. 2018; Stummer et al. 2018). Specifically, they provide a flexible exchange of information between all participating organizations, while simultaneously reducing the number of interfaces that are otherwise required for communication.

Previous research has mainly focused on the bright side of MSPs, such as the triumphal march of Airbnb or game consoles (Chu and Manchanda 2016). However, causes for the demise or even collapse of MSPs have rarely been considered in previous research, such that important aspects of the dark side of MSPs might have been overlooked. Practical evidence, such as the \$4 billion collapses of General Electric's MSP "Predix" shows the enormous severity of platform failures and underpin the need for further research (Scott et al. 2017). Although a comprehensive body of knowledge of factors that promote the success of MSPs has accumulated in research (de Reuver et al. 2018; Fichman et al. 2014), MSPs still often fail in practice. Moreover, previous research contributed only anecdotal evidence and neglected the effects of inhibiting factors on network effects (de Reuver et al. 2018). Indeed, knowledge about factors inhibiting MSP diffusion is of particular importance to extend existing technology diffusion and adoption models and increase their explanatory and predictive validity. Taken together, this illustrates both the practical and theoretical necessity to examine factors that inhibit the success of MSPs. In light of this research gap, de Reuver et al. (2018) or Schrieck et al. (2018) call for a deeper understanding of MSPs and, in particular, of the factors inhibiting MSP diffusion. Basically, diffusion refers to the spread of technologies within networks or organizations (Rogers 2010), and diffusion enables a large potential to improve operational efficiency

and competitive agility for long-term survival (Benlian and Hess 2011; Zhu and Kraemer 2005). A key characteristic and important driver for MSP diffusion are network effects (Hagiu and Rothman 2016). Network effects arise when a critical mass of users is reached, and then either exponential growth kicks in or the platform collapse (Hagiu and Rothman 2016; Stummer et al. 2018). Scholars differentiate between four types of network effects: same-side and cross-side network effects as well as positive and negative network effects (Evans and Schmalensee 2016; Parker et al. 2016). In general, a network effect is the marginal effect of an additional platform user on the existing users on the same side of the market (same-side network effect) or on the other side of the market (cross-side network effect). Positive network effects increase the platform value of existing users, while negative network effects decrease this value (Thies et al. 2018). Thus, positive and negative network effects are the main driver of the change in the value of a platform, and they might lead to the success or failure of an MSP (Tiwana et al. 2010). While previous studies analyzed the role of network effects predominantly in the B2C or C2C context (e.g., Chu and Manchanda 2016; Thies et al. 2018; Voigt and Hinz 2015), we focus on network effects in the B2B context. Existing findings from B2C research cannot be transferred to the B2B context because organizations should not be considered singular entities, and thus, various interdependencies between organizations need to be taken into account by analyzing network effects in B2B contexts (de Reuver et al. 2018).

The governance structure within the network, for example, influences these interdependencies and thus also the MSP diffusion in B2B networks (Choi et al. 2010). In the worldwide operating chemical industry, the platform “ELEMICA” constitutes a successful example of MSP diffusion (Christiaanse 2005). This successful diffusion can be mostly attributed to the “lead-organization governed network” structure within the industry (Alt and Fleisch 2000; Son and Benbasat 2007), which is most prevalent in stable long-term buyer-supplier relationships such as traditional supply chains (Provan and Kenis 2008). In contrast, in “shared participant governed networks”, where many ad hoc and dynamic changing buyer-supplier relationships are often widespread, MSP diffusion seems to be less successful. Thus, factors seem to exist that inhibit the diffusion of MSPs in these dynamic multi-stakeholder networks. Furthermore, the number of actors as well as the frequent changing buyer-supplier relationships are often associated with high substitutability of actors, which leads to highly competitive pressure between

actors within B2B networks (Farahani et al. 2014). Previous MSP research studies did not address this issue sufficiently and thus the literature still lacks consideration of MSP failures in highly competitive B2B networks where multiple stakeholders dynamically operate in an environment of frequently changing relationships. To address the research gaps presented above, we ask the following two research questions:

RQ 1) What are the key factors inhibiting the diffusion of MSPs in highly competitive B2B networks, and how do they influence positive or negative network effects?

RQ 2) To what extent do the inhibiting factors affect cross- or same-side network effects?

To answer these research questions, and responding to the calls of Hong et al. (2013) and Te'eni (2015) for a stronger contextualization of studies, we chose the highly competitive air cargo transport sector as a suitable research context. This sector is highly competitive for several reasons. First, although worldwide cargo volumes are increasing, air cargo is losing market share to sea and land transportation (IATA 2018; Wang et al. 2017). Second, transport and handling services are hard to differentiate, and organizations are threatened by interchangeability (Delfmann et al. 2002). Thus, on the one hand, MSPs have high potential to increase process efficiency and to reduce the still widespread time-consuming paper-based processes in this sector. On the other hand, MSPs increase transparency, reduce the cost advantages, and foster the interchangeability of services or organizations. As a concrete, highly competitive B2B network, we selected the largest air cargo hub in Europe at the airport in Frankfurt, Germany (Mayer 2016). In 2008, a cargo community system (CCS), which fulfills the characteristics of an MSP (Tiwana et al. 2010), was introduced. Ten years after its introduction, however, the CCS has remained underutilized by the organizations at the air cargo hub (with a usage rate of approximately 20 %). This indicates that several inhibiting factors might have been at play, providing a fertile ground to examine our research questions.

We contribute to research on MSP diffusion and inter-organizational information systems (IOIS) adoption in several important ways. First, answering calls for research from de Reuver et al. (2018) and Schreieck et al. (2018), we extend the scarce literature on MSP diffusion in highly competitive B2B networks by unraveling 21 core inhibiting factors that slow down MSP diffusion in these networks. Second, by integrating platform research with technology diffusion research, we also add to a deeper understanding of

MSP diffusion by depicting which types of network effects exactly are affected by the identified inhibiting factors. Third, we also advance IOIS adoption research (Kurnia et al. 2019) by revealing the interrelationships between multilevel contextual (e.g., regulatory or strategic) factors and network effects, which have been largely neglected so far.

The remainder of this paper is structured as follows. In the next section, we present the theoretical background with regard to MSP diffusion and competitive B2B networks. Then, we introduce our research case, followed by a description of our research methodology. Subsequently, we present our results. Finally, we discuss the results, draw theoretical and practical implications and present avenues for future research.

4.2 Theoretical Background

4.2.1 Multi-Sided Platform Diffusion

An MSP coordinates the requirements of more than two different actor groups, which are dependent on each other (Evans and Schmalensee 2016; Parker et al. 2016). Many scholars emphasize, in their definitions of MSPs, the existence of network effects with a direct impact on MSP diffusion (Ceccagnoli et al. 2012; Eisenmann et al. 2011). In general, network effects can lead to an exponential growth of a platform. Usually, the high acceleration starts when the mutual baiting problem (chicken-and-egg dilemma) is solved (Parker et al. 2016). The chicken-and-egg dilemma deals with the quagmire that organizations only use a platform if it provides a benefit, but the benefit of the platform results from the increasing number of organizations using the platform (Tiwana 2013). At first, this appears to be unsolvable. A closer look, however, indicates that when it is solved, a self-reinforcement effect occurs (Arroyo-Barrigüete et al. 2010; Wan et al. 2017). In literature, the chicken-and-egg dilemma is considered solved when a critical mass of individuals or organizations participates on one platform side. This situation is reached when the ratio between additional and quitting actors is positive (Tiwana 2013).

From a theoretical perspective, four types of network effects exist: positive, negative, same-side, and cross-side network effects (Parker et al. 2016). Positive and negative network effects indicate the change in the network utility caused by an additional subscriber (Shapiro and Varian 1998). A positive network utility exists, for example, in the use of messaging services such as fax or real-time collaboration tools such as Skype for Business. If one additional person uses the service, the utility of the entire network

risks because opportunities to communicate increase. In the case of negative network effects, the benefit of using the platform decreases with an additional subscriber because, for instance, the performance of the platform declines (Shapiro and Varian 1998). Same-side network effects occur on the same platform side among organizations within the same actor group. In contrast, cross-side network effects occur between organizations of different platform sides. Noteworthy cross-side network effects appear more often than same-side network effects, and they are not necessarily symmetrical (Arroyo-Barrigüete et al. 2010; Parker et al. 2016; Wan et al. 2017). Figure 11 illustrates the relationships of cross- and same-side network effects.

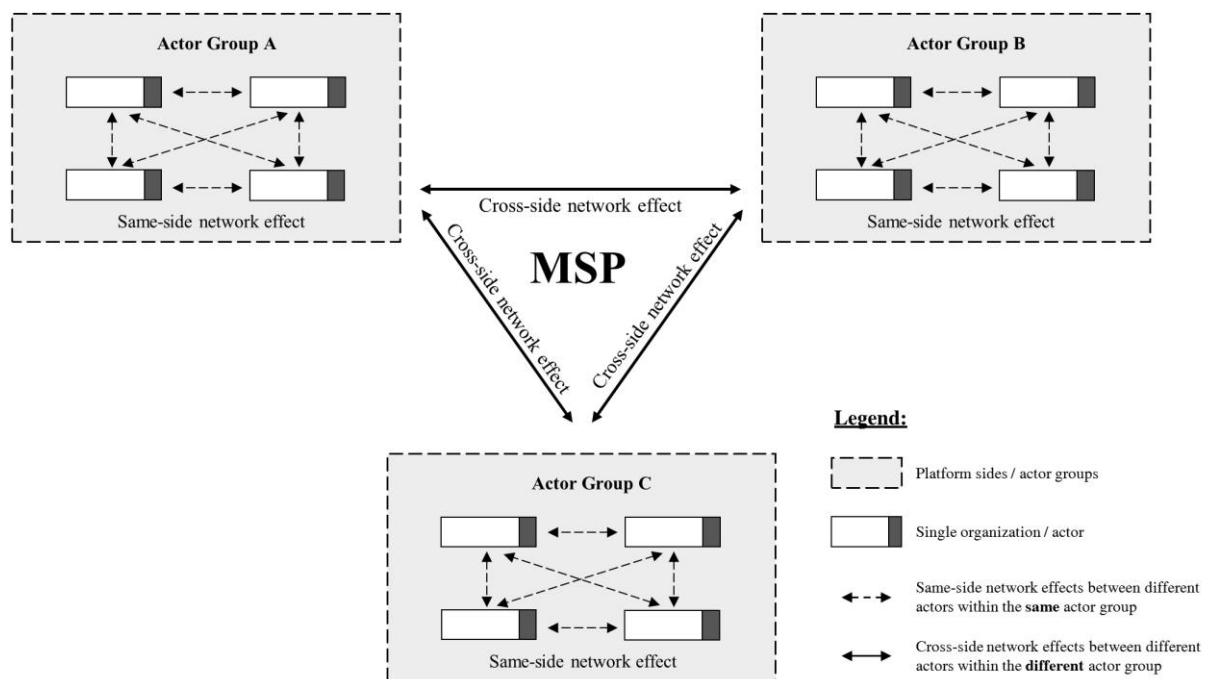


Figure 11: Cross- and same-side network effects in the context of MSP.

The self-reinforcing characteristic of network effects influences multiple stages of the diffusion process. In general, diffusion is “a kind of social change, defined as the process by which alteration occurs in the structure and function of a social system” (Rogers 2010, p. 6) and requires the usage of technology. The diffusion of innovations theory constitutes one of the most popular and applied theories in the assimilation and diffusion literature (e.g., Angst and Agarwal 2009; Oliveira et al. 2014; Wright et al. 2017). Although the theory was originally designed to explain the individual perspective of diffusion, scholars broadened their lenses and adopted the underlying concept to the intraorganizational context (Wallbach et al. 2018; Wright et al. 2017; Zhu et al. 2006c). In these intraorganizational contexts, scholars applied a three-stage assimilation process

to illustrate the use of technology. First, there is the creation of an initial awareness; second, there is the formal adoption; and third, there is the final full-scale deployment in which activities become routine (Wright et al. 2017; Zhu et al. 2006c).

Applying these theoretical insights to MSP diffusion, the three-stage intraorganizational assimilation process influences the interorganizational MSP diffusion. Put simply, the MSP diffusion process can be regarded as a multiple intraorganizational assimilation process in which every single stage can influence succeeding stages as well as single stages of the assimilation process within other organizations (see Figure 12). More specifically, first, one single stage can influence the progress within one organization (intraorganizational assimilation process); second, one stage can influence the progress between several organizations within the same actor group (induced by same-side network effects). Third, one stage can influence the progress between several organizations of different actor groups (induced by cross-side network effects). This detailed consideration is in line with Oliveira et al. (2014), who emphasize that influencing factors need to be considered as granularly as possible to understand the underlying mechanisms of the MSP diffusion process. They argue that the diffusion process in B2B contexts is more complex than the individual assimilation process, and therefore needs an in-depth consideration. One reason for the complexity is that each organization may be in a different stage of the assimilation process.

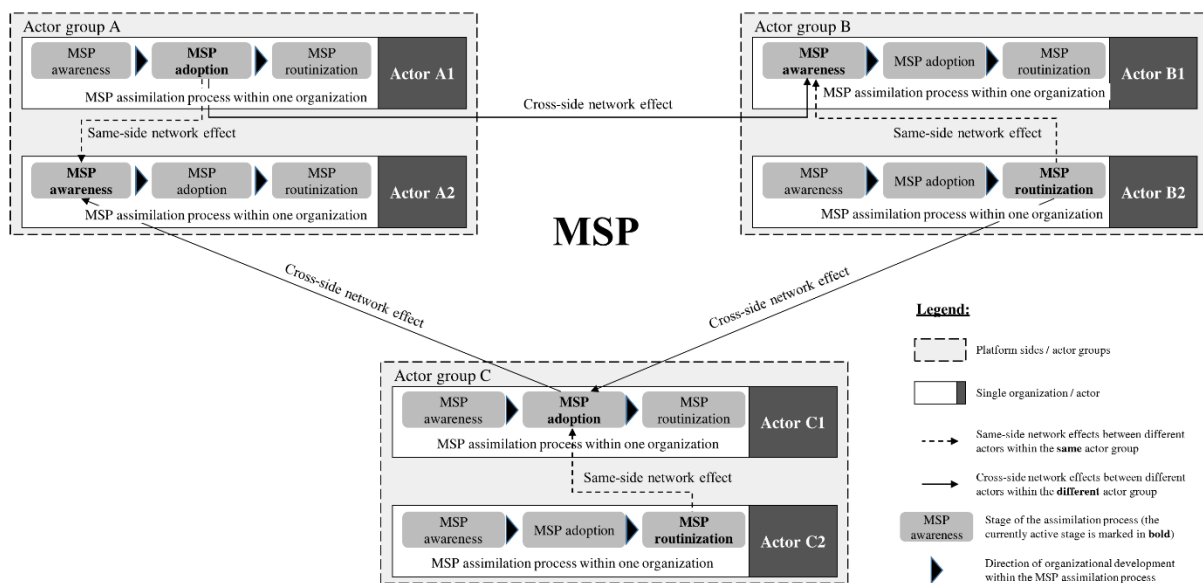


Figure 12: Process of MSP diffusion within a competitive B2B network.

Moreover, scholars propose to transcend the mainly positive observations and make appeals for a more critical consideration of factors inhibiting MSP diffusion in a B2B context (Benlian et al. 2018; de Reuver et al. 2018; Jede and Teuteberg 2016). Kembro et al. (2017) responded to these calls and considered the barriers in supply chains (with long-term business relationships). However, the network structures in conventional supply chains, with mostly established buyer-supplier relationships and clear governance structures, are not comparable to highly competitive B2B networks. Hence, it can be assumed that additional influencing factors exist, which require further investigation.

4.2.2 Competitive B2B Networks

Aarikka-Stenroos and Ritala (2017) highlight that especially competitive B2B networks need further theoretical and empirical consideration because findings from B2C networks cannot be transferred to their full extent. Increasing connectivity and interdependence, as well as coevolution of organizations and technologies, are some reasons for these competitive business marketplaces (Rezapour et al. 2011). These attributes cause a vast rise in complexity to be reinforced: First, by the number of organizations involved; second, by the degree of interconnected processes and dependencies between organizations; and third, by evolving data exchanges and the often nontransparent contractual situations between actors (Pagani and Pardo 2017).

Based on the characterization of competitive models by Farahani et al. (2014), we differentiate between three types of competitive B2B networks: weak or noncompetitive B2B networks, conventional or medium competitive B2B networks, and pure or highly competitive B2B networks. We provide a comprehensive overview of the network classifications, including their focal attributes in Figure 13.

Common market structure	[quasi-] monopolistic (no or weak competition)	oligopolistic (imperfect competition)	polypolistic (perfect competition)
Market share Market barriers Market price control of individual organizations	high		low
Regulation imposed by	government		market
Product or service characteristics	unique		interchangeable
Common governance structure	lead-organization governed network	lead-organization governed network	shared participant governed network
B2B network structure	weak or noncompetitive B2B network	conventional or medium competitive B2B network	pure or highly competitive B2B network

Figure 13: Attributes of competition referring to corresponding B2B networks.

In noncompetitive B2B networks, monopoly structures are prevalent, high market entry barriers often exist and products or services are not substitutable. Furthermore, the involved participants often maintain long-term business relationships with each other. The exact opposite of noncompetitive B2B networks are highly competitive B2B networks. Highly competitive B2B networks are characterized by polypolistic market structures, goods, or services that are easily substitutable, and organizations have only a little price control. A further important criterion is that multiple stakeholders interact in the network, business relationships are loose and vary dynamically in the network, and ad hoc cooperation is part of the daily business activities. In between, medium competitive B2B networks where the usual traditional supply chains fit in, are prevalent. These are prevalent when the elevated requirements of highly competitive networks are not met. However, it is important not to consider this classification as a rigid categorization. The intensity of competition varies continuously between the two extremes of the noncompetitive B2B networks up to the highly competitive B2B networks.

4.3 Research Case

4.3.1 Air Cargo as a Highly Competitive B2B Network

Air cargo is mainly chosen for valuable, dangerous, or time-sensitive goods (Barz and Gartner 2016; Christiaanse and Zimmerman 1999). Despite that, most of the goods' transport time is waiting time, which is caused by the inefficient communication between actors (Elbert et al. 2017). In the highly competitive B2B network of air cargo, multiple organizations are involved in the transport process. Low margins, high dynamics, and many-sided coopetition (organizations that compete and cooperate simultaneously) between organizations result in highly competitive network structures and inefficient information flow (Harris et al. 2015; Perego et al. 2011). Due to overdue transport order information (caused by, e.g., production uncertainties), the introduction of an MSP is particularly interesting to provide relevant transport information to the appropriate organization as soon as the information is available (Naim et al. 2006).

We illustrated the relationships for the physical flow of goods and the information between the actor groups in Figure 14. In our research scope, we focus on precarriage organizations located at the airport because, first, at the airport, the transport information must be electronically available for the customs process. Second, due to nonexistent contractual relationships, a gap between the physical flow of goods and the information flow emerges between the actors at the hub. Thus, all relevant actor groups of the transport process at the air cargo hub are represented in our research case. In sum, the platform promises to reduce time and effort by not having to enter the same information into several proprietary systems. These advantages are not limited to the actor groups contained within the research scope and can be transferred, analogously, to other actors in the network.

In the beginning, the sender assigns a transport order to a forwarder, who usually coordinates the transport network in the air cargo business (Perego et al. 2011). Within this process, the forwarder requests transport capacity, often by phone, from airlines and truckers who conduct the road transport from the sender to the forwarder's consolidation hub. The consolidation hub can be located locally, close to specific senders, or directly at the airport. The forwarder consolidates cargo (with an optimal weight volume mix) on air cargo pallets. The trucker transports the pallets and loose cargo to the handling agent. The handling agent consolidates the remaining loose cargo and provides the

pallets to the airlines at the apron. At this point, the main-carriage starts, and the pallets are transported by the airline to the destination airport.

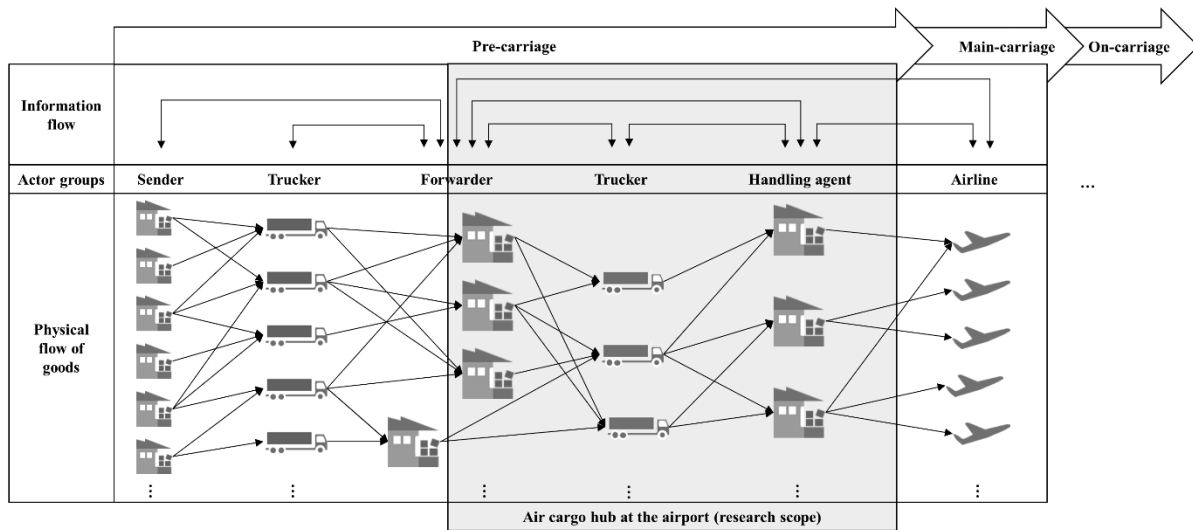


Figure 14: Relationships between actor groups of an air cargo network.

One major challenge in this highly competitive network is the contractual situation between organizations. The handling agent is contracted by the airline, and the trucker by the forwarder. As a consequence, often, no direct interface exists to share information between the forwarder, trucker, and handling agent. However, because of the direct linkage in the physical flow of goods, these organizations should benefit the most from early information exchange to reduce uncertainties as well as to improve processes. Transport information between organizations is usually transmitted via phone, fax, and e-mail (Harris et al. 2015). Consequently, each organization is currently entering relevant transport information into its own proprietary system. Although implementation costs and efforts need to be evaluated individually, most of the organizations may benefit from an MSP, where all actor groups have access to the relevant information electronically. However, research on the air cargo network in Europe, Asia, and the US has shown that most of the attempts at implementing such community systems failed (e.g., the cargo platform “Reuters”). Reuters failed because the provider underestimated the complexity of the existing highly competitive network (Christiaanse and Damsgaard 2006).

4.3.2 Cargo Community System: The MSP at the Air Cargo Hub in Frankfurt

The air cargo hub in Frankfurt, Germany, with more than 250 logistics organizations and a high level of coopetition at the hub, is a highly competitive B2B network. Over 2 million tons of cargo makes the hub the largest cargo handling airport in Europe and one of the top ten worldwide (Airport Council International 2016; Fraport AG 2016). In 2008, organizations of the different actor groups at the cargo hub decided to implement a community system to handle the cargo at the airport more efficiently. To drive the implementation, an established CCS provider from the cargo environment was selected. The provider creates value by providing a stable infrastructure for an automated service (its core activity), grounded on its key resources: experience from former projects and experienced platform developers. The CCS connects organizations within and between different actor groups (i.e., forwarder, trucker, handling agents, and airlines) and fulfills the requirements of an MSP. In addition, multiple complementing modules extend the functionalities of the CCS (e.g., customs, warehousing processes) and can be provided by multiple service providers and partners. This demonstrates that an ecosystem around the CCS arises, and network effects may exist. The aim of the CCS is to improve process efficiency and quality standards at the hub, where all actor groups can establish electronic controlled access to relevant transport information. The value proposition consists, among other things, in the reduction of manual data entry, telephone queries, and errors as well as better planning and disposition, with more transparency. The value of the CCS is captured through license and pay per use fees (which especially cover software development costs), and most important channels are trade fairs, personal advice, and word of mouth.

Despite a skilled CCS provider with an established business model was chosen, more than ten years later, the platform is still far away from being a standard. As stated by the service provider, approximately 20 % of the organizations at the hub have direct access to the CCS and the usage rate of these connected organizations is approximately between 10-30 % of their total number of transport orders.

4.4 Research Methodology

To discover factors influencing the diffusion of MSPs, we pursued a systematic approach in accordance with grounded theory. Grounded theory, developed by Glaser and Strauss

in 1967, is a qualitative methodology suitable to explore an area not yet thoroughly researched and to inductively build theory grounded in data (Corbin and Strauss 2015). In accordance with Sarker et al. (2018), we categorize our study as inductive and data-centric research. Inductive approaches serve to discover new factors and typically follow systematic coding strategies or the so-called "ladder of analytic abstraction" (Miles et al. 2013). Data-centric approaches consider data as a single entity with a fixed meaning, and the knowledge or insight is derived by systematically processing the data, excluding interpretation-centric characteristics such as text excerpts, without a fixed meaning, or the consideration of emotions (Sarker et al. 2018). For this investigation type, Sarker et al. (2018), suggest a grounded theory approach. In addition, grounded theory is suitable for exploring new factors (Lawrence and Tar 2013) and for broadening the existing theoretical lenses of the MSP diffusion process with the underlying assimilation processes as well as the impact on network effects. Therefore, this methodical approach is well suited to examine our research questions. The data was gathered in face-to-face interviews. The data is analyzed by conducting a process termed constant comparison (Corbin and Strauss 2015). In this inductive, case-oriented, iterative process, the data collection procedure is continuously adapted to the prior discovered findings, which means that data gathering is accompanied by data analysis until the researchers achieve saturation, and no further findings are expected (Corbin and Strauss 2015; Eisenhardt 1989).

To achieve high external validity, we applied the stakeholder theory (Mitchell et al. 1997) and selected a sample of all relevant organizations within our research scope. Analogously, we identified our interview partners with respect to equal distribution within actor groups, company focus and hierarchical levels. Furthermore, we ensured that the different stages of the assimilation process are represented in the sample. By this selection procedure, we could achieve a broad spectrum of opinions and avoid interview biases. The interview guidelines contain semistructured questions and are categorized into three theme blocks to explore different perspectives: First, the description of the as-is situation including knowledge and application of the CCS at the air cargo hub, second, the evaluation of the CCS including challenges and barriers and third, expectations of a to-be situation including the diffusion process and network effects. To ensure a common understanding of our guidelines, we verified them iteratively in several pretests, with researchers not involved in the design phase.

Each interview was analyzed directly after it was finished to guide the next interview. The termination criterion was defined to stop interviews when no additional codes are needed, and all statements in the transcript can be assigned to the prior developed coding (Beattie et al. 2004; Eisenhardt 1989). This was achieved after nine interviews because, in the tenth interview, no further codes were added. We conducted one additional interview (no. 11) to confirm that the termination criterion was achieved. In addition, four interviews (no. 12-15) were performed with service providers offering the CCS or other modules and software solutions at the cargo hub. These four interviews were not undertaken to develop further coding but rather to validate the findings from the actor groups. In total, 15 interviews with more than 20 interviewees were conducted from August 2017 until January 2018. All interviews were audio-recorded and transcribed, resulting in approximately 300 pages of input. Any inconsistencies that emerged in the transcription process were resolved in discussions among the authors. In this process, two researchers focused on coding and evaluation. The remaining researchers separately validated the plausibility of the evolving coding to clarify inconsistencies. Table 5 summarizes the interview details.

No.	Actor Group	Company focus	Hierarchical levels (professional experience in years)	# Interviewees	Interview Duration	Codes added?
1	Handling Agent	Global	Employee customer service (19) / warehouse (22)	2	1:39	Yes
2	Handling Agent	Local	Employee customer service (10)	1	0:49	Yes
3	Forwarder	Global	Import and export clerk (19)	1	1:25	Yes
4	Forwarder	Global	Senior vice president (30)	1	1:23	Yes
5	Trucker	Local	Employee dispatcher and transport (9)	1	1:03	Yes
6	Forwarder	Global	Site director (32)	1	1:41	Yes
7	Forwarder	Global	Employee import (10) / export (18) / warehouse (14)	3	1:36	Yes
8	Trucker	Global	Managing director (18)	1	1:35	Yes
9	Handling Agent	Global	Customer service manager (31 / 25)	2	1:33	Yes
10	Forwarder	Global	Vice president (17)	1	1:22	No
11	Handling Agent	Local	Managing director (28)	1	0:52	No
12	System provider	Local	Vice president trade solutions (6)	1	1:19	-
13	System provider	Local	Senior managers communication services (33 / 9)	2	1:14	-
14	System provider	Global	Business partnership manager (12) / implementation consultant (7)	2	1:29	-
15	System provider	Global	Managing director (34)	1	1:37	-

Table 5: Interview metadata.

We analyzed our data by using MaxQDA12, which is a widely used research tool for applying a systematic coding procedure (Kuckartz 2014; Mayring 2014). We used three types of coding: open, axial, and selective coding (Batra et al. 2017; Beattie et al. 2004). The objective of the first order coding is to produce codes. Therefore, we used open coding in the initial phase to reveal the main ideas in each transcript and break down the gathered data. This means that the developed codes are directly extracted from, and linked to, the interview transcripts. To ensure a common understanding of the emerging codes in this procedure, we used Cohen's kappa (k) as an indicator of agreement between researchers coding the same transcript sections for randomly selected subsets. The commonly accepted threshold is above $k=0.70$ (Benlian et al. 2011; Cohen 1960). We surpassed this in all tested subsets. In the second-order coding, axial coding was utilized to put data back together in a relational form into categories, which in this case, represented the inhibiting factors. The third form of coding, selective coding, involved the process of systematically relating the factors to a higher level of abstract generality called overarching themes (Wiesche et al. 2017). We discussed the evolving codes, factors, and themes thoroughly with researchers and practitioners to ensure validity and objectivity.

4.5 Results

4.5.1 Factors Inhibiting MSP Diffusion and Their Impact on Positive and Negative Network Effects

To answer our first research question, we structured the results by the overarching themes. For each overarching theme, we will present our identified inhibiting factors and explain the meaning as well as their inhibitory influence on positive and negative network effects by using a selected factor. We present a comprehensive overview of all factors, including their definitions and exemplary quotes, in Figures 15-19.

Initially, we established 56 codes in the first-order coding stage. Afterward, we followed the systematic procedure of axial coding and derived 21 factors, which represent the inhibitors of MSP diffusion and are the main subject of our investigation. These factors represent network-wide factors since we aggregated and analyzed the quotes collectively across all actors and actor groups. Furthermore, we aggregated these 21 factors into five overarching themes, which serve to structure and summarize the factors into complementing areas of activities. In the next step, we examined the interviews again

with regard to network effects. In doing so, we revealed that our investigated CCS generates the typical platform network effects characteristics, which is illustrated by quotes such as “*The more organizations involved the better. The further development of the system can offer [actor groups] more advantages so that more [organizations] come on board*”. Moreover, quotes such as “*For example, the [organization] unsubscribed [...], now they realize the advantages through the participating organizations and come back.*” indicate that the critical mass is achieved and the chicken-and-egg dilemma is solved. In general, network effects arise from different actions related to CCS usage. By using a CCS, positive network effects emerge due to a faster and more transparent flow of information and physical goods. In contrast, negative network effects evolve due to the declining performance of the CCS caused by additional subscribers. Although we asked our interviewees explicitly for negative network effects, no one shared these concerns. Thus, we only identified an inhibitory impact of our factors on positive network effects.

4.5.1.1 Technical and Regulatory Requirements

Our overarching theme *technical and regulatory requirements* (see Figure 15) is determined by four factors, *IT infrastructure*, *functionalities*, *legal* and *community-specific requirements*. Compared to the succeeding highly competitive B2B network-specific factors, these factors can be considered universal because they are known from the literature on existing medium competitive B2B networks (e.g., Kembro et al. 2017). Nevertheless, we briefly explain one exemplary factor of this overarching theme. The inhibiting factor *functionalities* are attributable to missing features, functions, or modules of the platform. Obviously, if functions are missing, which are essential for potential subscribers, the diffusion of the system is inhibited.

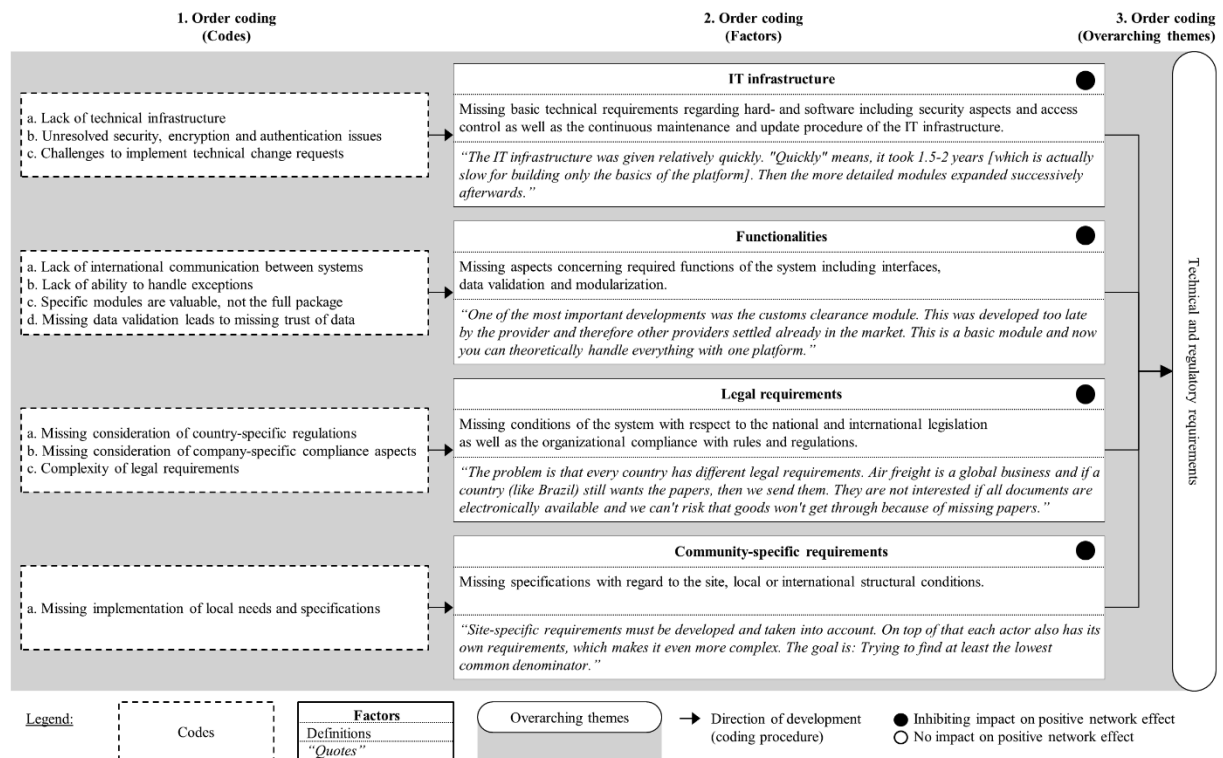


Figure 15: Overview: Overarching theme technical and regulatory requirements.

With regard to the impact on network effects, all factors within this overarching theme confirm that they inhibit the emergence of positive network effects. If we stick to our factor *functionalities*, it is obvious that if required *functionalities* of the system are missing, positive network effects cannot kick in because of the absence of additional subscribers. In addition, positive network effects can be realized when the inhibiting influence of the factor is reduced.

4.5.1.2 Mindset

In our overarching theme *mindset*, we identified seven factors. As illustrated in Figure 16, three factors (*recognized potential of the system*, *implementation of workarounds* and *blaming other actors*) contain, and four factors (*management commitment*, *qualified workforce*, *spirit of innovation* and *perceived ease of use*) do not contain, statements referring to network effects.

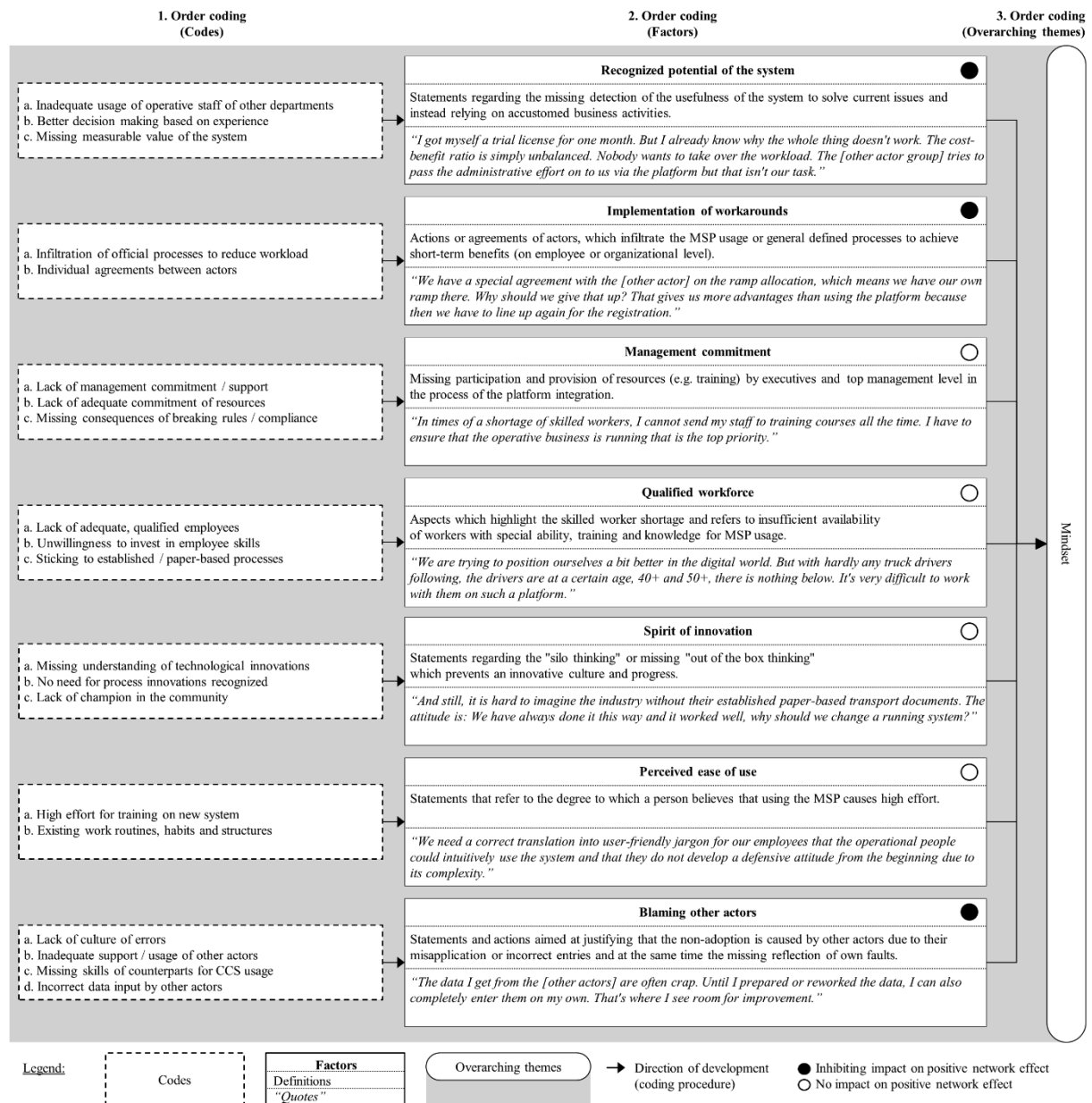


Figure 16: Overview: Overarching theme mindset.

First, we take a closer look at the factor *implementation of workarounds*, which encompasses actions that infiltrate official processes in order to generate individual advantages on an employee or intraorganizational level. Statements such as “We have a special agreement with the [other actor] on the ramp allocation, which means we have our own ramp there. Why should we give that up? That gives us more advantages than using the platform [...]” demonstrate the inhibiting effect of this factor on platform diffusion. The individual advantages generated by these specially arranged workarounds prevent organizations from subscribing to the platform, and thus the impact on positive network effects is inhibited. In contrast, fewer workarounds will shrink the inhibitory influence

of the factor. In this case, the total utility of the network rises, and the realization of positive network effects increases. Second, we consider a factor that refers exclusively to internal organizational barriers. The factor, *perceived ease of use*, is an important factor influencing the initial acceptance of information systems in a personal context and determines the degree to which a person believes that using a system will improve their job performance (Davis 1989). This factor is also known from existing literature in the B2C context and refers to a subjective perception of an individual, which has no influence on network effects.

4.5.1.3 Characteristics of the System Provider

The overarching theme characteristics of the system provider (see Figure 17) contains three factors: neutrality of the system, reliability of the system provider, and communication of functionalities. The factor, communication of functionalities, highlights that the initial focus of the system provider on marketing activities instead of professional consulting led to irritations and thus inhibited the diffusion of the CCS.

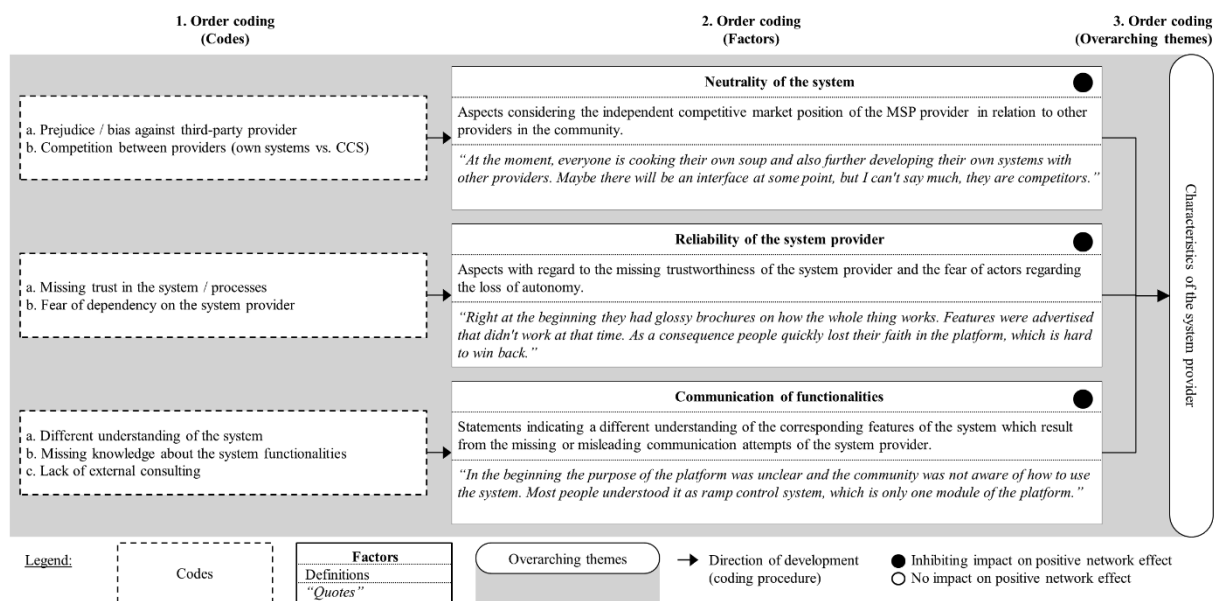


Figure 17: Overview: Overarching theme characteristics of the system provider.

Our analysis confirms that network effects emerge not only due to technical advancements but also due to communication activities. Word of mouth is, for instance, an accelerator of network effects (Choi et al. 2010). Hence, the impact on positive network effects is inhibited because missing or wrong communication creates a wrong understanding of the platform. If functionalities are communicated more comprehensively and are understandable to all members of the network, word of mouth

can generate a self-reinforcing effect and thus promote, instead of inhibit, the impact on positive network effects.

4.5.1.4 Competition

Our overarching theme competition is presented in Figure 18 and contains four factors *conflict of interest*, *contractual relationship*, *governance structure*, and *community idea*. The basic idea of the factor *community idea* is to strengthen the hub location for all participating organizations with the long-term growth of the hub and thus to generate additional individual benefits. This may require that common goals must be placed over individual goals. This is challenging because organizations usually prioritize their own investments and often concentrate on short-term profit goals, which highlights an area of tension and associated inhibitory issues.

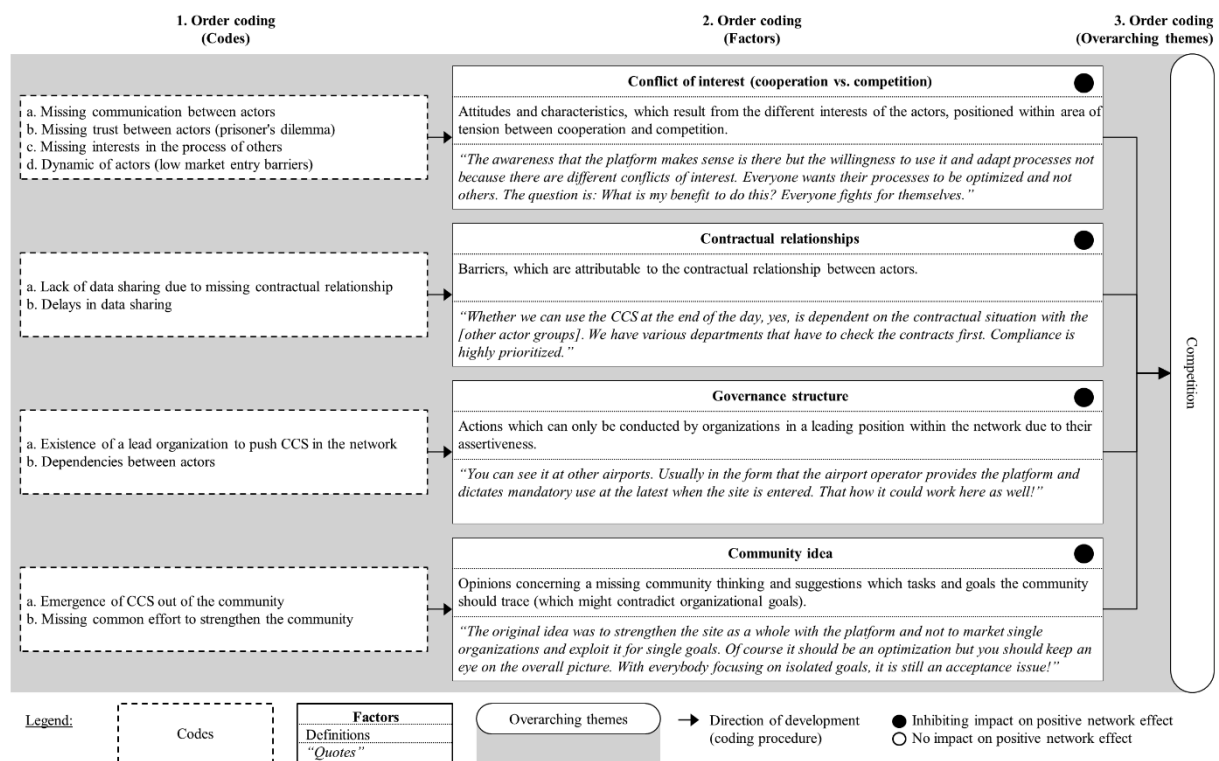


Figure 18: Overview: Overarching theme competition.

However, if this *community idea* becomes more popular and the advantages of the community are clear and convincing, the positive and accelerating power is very strong. To reduce the inhibiting effect on network effects, companies must realize that the common goals of the community reveal valuable benefits and that they must participate in the community to be competitive.

4.5.1.5 Process

The overarching theme, *process*, covers the last three factors (see Figure 19). The factor *internal processes* does not contain any statements referring to network effects. However, the remaining factors *external processes* and *process dynamics* contain such statements.

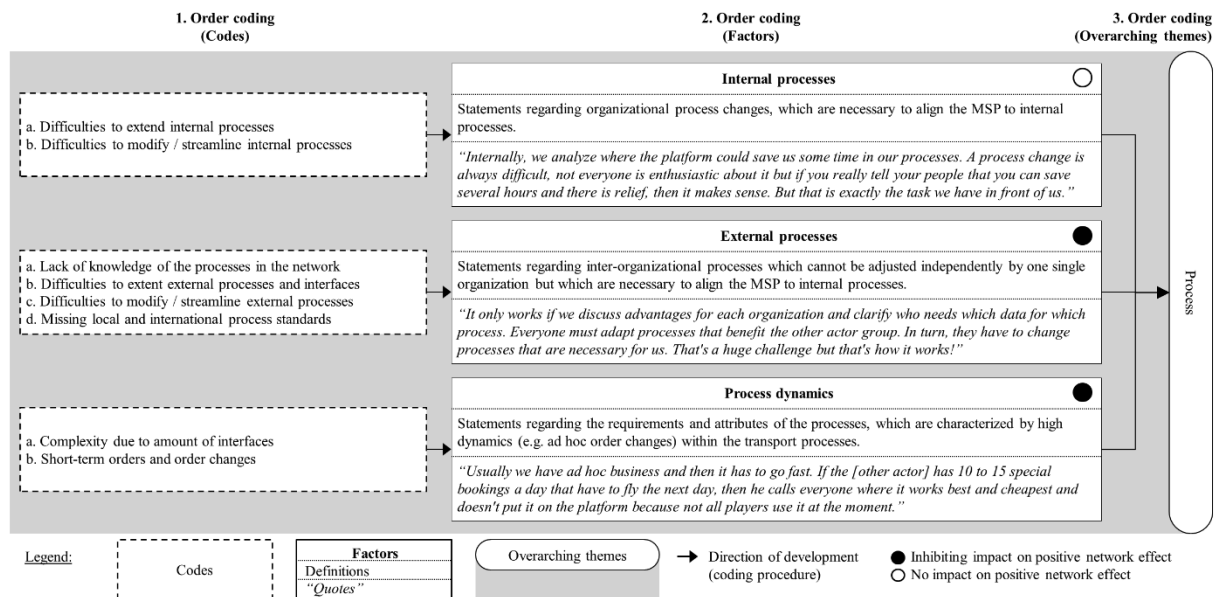


Figure 19: Overview: Overarching theme process.

The factor, *external processes*, deals with the great number of heterogeneous processes at the hub. As known from the diffusion theory, technologies, and standards diffuse faster in homogeneous structures and become more valuable with a wider spread. Transferred to our regarded platform, the currently prevalent heterogeneous process landscape inhibits the impact on positive network effects.

In sum, we identified 16 factors with and five factors without an inhibiting influence on positive network effects in highly competitive B2B networks. For our further investigation, we exclude the five factors without an inhibiting influence because of their intraorganizational focus.

4.5.2 Impact of Inhibiting Factors on Cross- and Same-Side Network Effects

To answer our second research question, *"To what extent do the inhibiting factors affect cross- or same-side network effects?"*, we analyzed the 16 factors with regard to cross- and same-side network effects. Therefore, we developed two different measures that are content-based in accordance with Onwuegbuzie (2003) and formalized based on Polyanin and Manzhirov (2006). These quantification measures, also called quasi-

statistics or ratio, support the qualitative interpretation as well as the internal generalizability of the statements (Maxwell 2010). Moreover, they are widely used to quantify the relative importance and substantiate qualitative findings (Koch and Benlian 2015; Saldaña 2015). Our first measure, ratio (r_1), corresponds to the prevalence measure (also called frequency effect size) of Onwuegbuzie (2003) and enables the categorization of the factors inhibiting either cross-side or same-side network effects. We analyzed approximately 700 quotations with either an interorganizational vertical reference (referring to organizations of different actor groups; in the formula named as CrossSideQuotes) or an interorganizational horizontal reference (referring to organizations of the same actor group; named as SameSideQuotes). Based on this we calculated ratio r_1 by dividing the number of (#) CrossSideQuotes of one factor by the total number of quotes for this inhibiting factor. Formally this means, a factor (i) is represented by the tuple ($\#CrossSideQuotes$, $\#SameSideQuotes$, Category) whereby the category (c) is initially empty and determined in the next step through ratio r_1 :

$$r_1: \{i\} \rightarrow [0,1]$$

$$F := \{(\#CrossSideQuotes, \#SameSideQuotes, Category) \mid \#CrossSideQuotes, \#SameSideQuotes \in \mathbb{R}^+ \wedge category \in C\}$$

$$r_1(i) = \frac{\#CrossSideQuotes_i}{(\#CrossSideQuotes_i + \#SameSideQuotes_i)} \quad \forall i \in F$$

Within our 16 factors, we identified five with an equally distributed number of CrossSideQuotes and SameSideQuotes. During the discussion of these findings, we decided that these factors could not be categorized as having a major influence on either cross-side or same-side network effects. Therefore, we created an additional category that influences both cross- and same-side network effects. We named this category mixed-side network effects. Based on our calculated ratio, a ratio r_1 below 0.4 indicates a main impact on same-side network effects ($0 \leq r_1 < 0.4$), whereas a ratio r_1 above 0.6 indicates a main impact on cross-side network effects ($0.6 < r_1 \leq 1$). A ratio r_1 between 0.4 and 0.6 ($0.4 \leq r_1 \leq 0.6$) indicates an impact on mixed-side network effects. In doing so, we identified nine factors influencing cross-side network effects, two factors influencing same-side network effects, and five factors influencing mixed-side network effects. Consequently, we can confirm the statement from Arroyo-Barrigüete et al. (2010) that cross-side network effects appear more often. Beyond that, we discovered

mixed-side network effects, which result especially from the specific characteristics of highly competitive B2B networks.

Our second measure, ratio r_2 , evaluates the relevance of a factor within the category (cross-, same- or mixed-side network effects), which is in accordance with the intensity effect size measure by Onwuegbuzie (2003). This ratio is equivalent to the hit ratio, which is widely used for the measurement of how well items tap into categories (Benlian et al. 2011).

$$r_2: \{i\} \rightarrow [0,1]$$

$$C := \{\text{cross-side network effects, same-side network effects, mixed-side network effects}\}$$

$$r_2(i) = \frac{\#CrossSideQuotes_i + \#SameSideQuotes_i}{\sum_{j \in F, c_j = c_i} \#CrossSideQuotes_j + \#SameSideQuotes_j} \quad \forall i \in F$$

We calculated the sum of all quotes of one factor ($\#CrossSideQuotes$ plus $\#SameSideQuotes$) divided by the sum of all quotes of all factors in the corresponding category. The sum of all r_2 within one category is equal to 1. The final categorization based on r_1 (italic) and the relevance based on r_2 (colored) is illustrated in Figure 20.

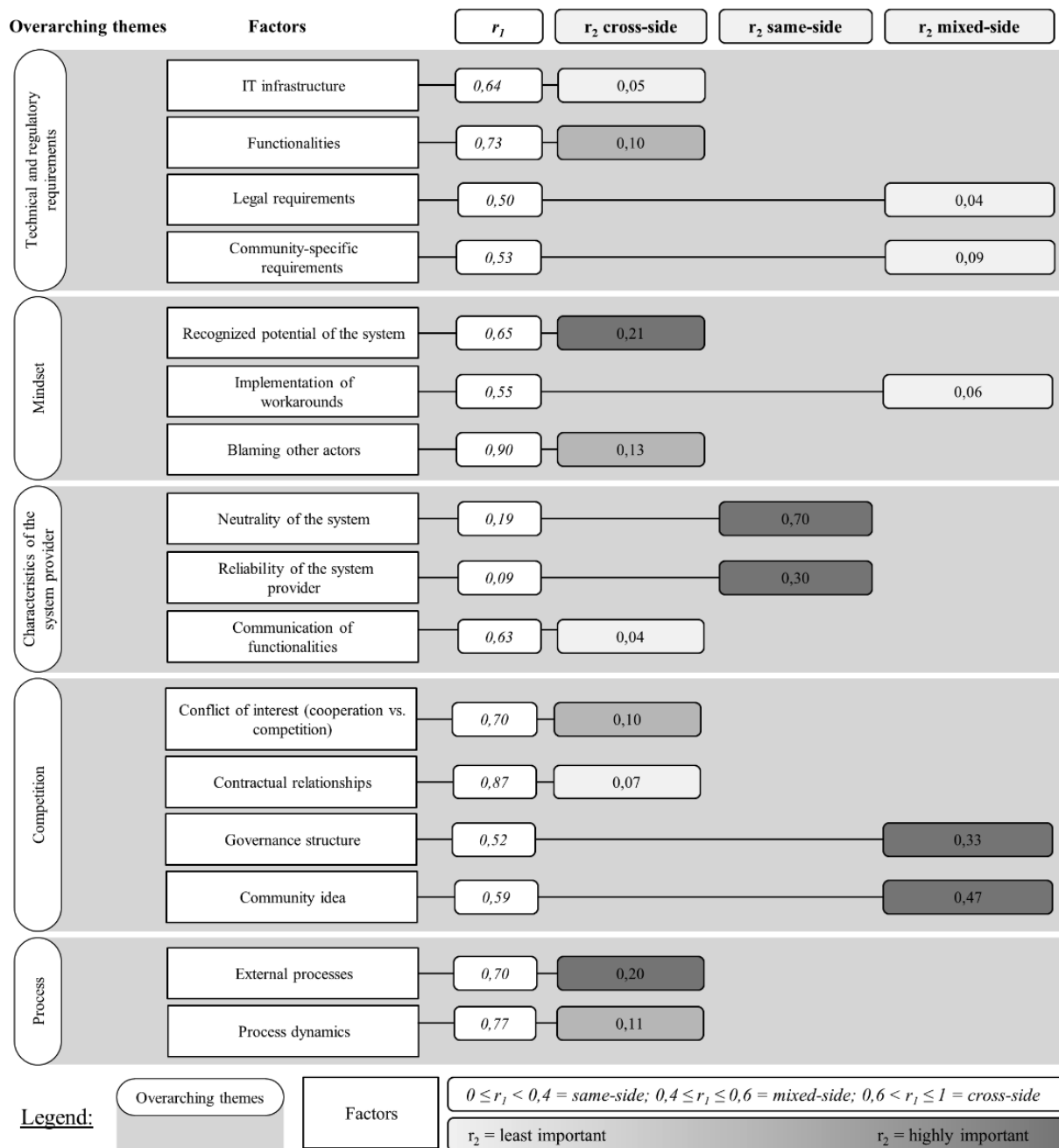


Figure 20: Overview and relevance of cross-, same- and mixed-side network effects.

With regard to r_1 , the following nine factors mainly have an impact on cross-side network effects: IT infrastructure, functionalities, recognized potential of the system, blaming other actors, communication of functionalities, conflict of interest, contractual relationships, external processes, and process dynamics. The factor recognized potential of the system has the highest ratio r_2 and the strongest impact on cross-side network effects (Figure 20, column r_2 cross-side). The factor refers to the issue that the need for the implementation of a CCS is not seen or misjudged, which inhibits positive network effects: “Already today we are contractually obliged to provide these data in case of

damage, loss, etc. This is one click in our system, and then the discrepancy message goes straight out. We do not need a new system for that [...].”

The factors, *neutrality of the system* and *reliability of the system provider*, with a major influence on same-side network effects (values see Figure 20, column r_2 same-side), both belong to the overarching theme characteristics of the system provider. The factor, *neutrality of system*, is the most relevant factor in this category. Organizations have prejudices against a profit-oriented system provider: “*The only thing they care about is profit*”. The progress of the CCS in providing various modules has reinforced the perceived competition between the CCS and other IT service providers: “*In fact, the problem of the [CCS provider] is that they entered into competition by abandoning the original idea to offer a pure platform and connect various existing systems. Due to these additional modules, providing solutions for customs and warehousing processes, they now competed with the established software providers, which now willfully obstruct to build interfaces to the [CCS provider]*”. This quote demonstrates that the actions of the system provider disrupt the existing ecosystem of the platform and thus inhibit same-side network effects.

The remaining five factors are *community-specific requirements*, *legal requirements*, *implementation of workarounds*, *governance structure*, and *community idea*. For these factors, we identified an impact on both sides (cross- and same-side) and categorized them into mixed-side network effects (values see Figure 20, column r_2 mixed-side). The factor *community idea* has the strongest impact with respect to r_2 on the mixed-side network effect. To generate long-term economic advantages for the participating organizations, the factor *community idea* aims to achieve a common growth of the hub. Organizations within one actor group are often confronted with similar challenges. In the course of collaborative exchange between community members of the same actor group, improvement potentials in relation to the CCS become visible and enable more efficient process flows. Thus, the pressure on companies that are in the same actor group increases. To stay competitive, they must use the CCS to optimize their processes accordingly. This influence corresponds to same-side network effects. A comparable effect exists between actors of different actor groups and causes cross-side network effects. Interdisciplinary exchange between different actor groups in the community increases the knowledge of the advantages of the platform and fosters the diffusion

within the network. This expresses the influence of the factor *community idea* on cross-side network effects.

4.6 Conclusions

4.6.1 Discussion of Results

The objective of our study was to investigate the diffusion of platforms in competitive B2B networks, which is a more complex process than in B2C environments such that findings in the B2C context cannot simply be transferred to the B2B context. Against this backdrop, we set out to examine factors inhibiting the diffusion of MSPs in highly competitive B2B networks, which are key to understand the demise and failure of platforms yet have remained under-researched in previous literature. Altogether, we identified 21 inhibiting factors for the diffusion of MSPs in highly competitive B2B networks and uncovered their potential impacts on different types of network effects, as depicted in Figure 21. While five factors mainly influence intraorganizational diffusion and thus are not expected to have an impact on network effects, 16 factors were identified as having unique impacts on network effects. More specifically, out of the 16 factors, nine factors were identified as having an impact on cross-side network effects, two on same-side network effects and five on both same- and cross-side network effects, which we called mixed-side network effects. Especially those inhibiting factors shaping mixed-side network effects are critically relevant and consequential in highly competitive B2B networks.

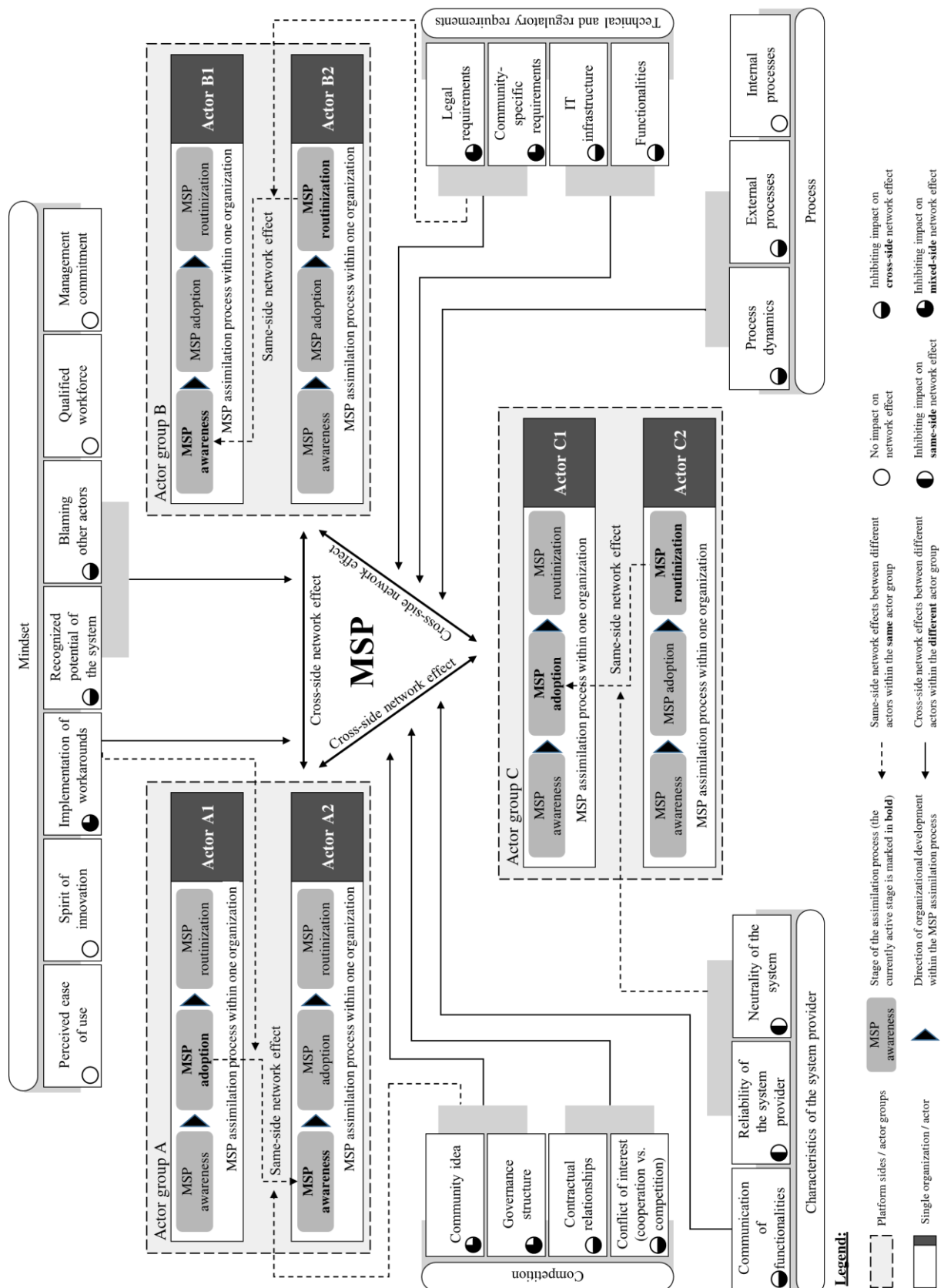


Figure 21: Summary illustration: Inhibiting factors and impacts on network effects.

We could not discover any evidence for negative network effects caused by platform usage. One explanation for this might be that the transport sector in general and the air

cargo sector, in particular, live by a “hands-on” mentality characterized by fast and uncomplicated problem-solving. This pragmatic solution-oriented approach of the people in the sector could have led to the fact that our interviewees did not perceive any negative network effects of using the CCS. We still suspect that MSPs, in general, can have negative network effects, which might occur in other sectors and are also characterized by highly competitive network structures but operate without this pragmatic mentality. Overall, our findings have important theoretical and practical implications and suggest avenues for future research.

4.6.2 Implications, Limitations, and Future Research

Our study contributes to the existing body of research on MSP diffusion and IOIS adoption in several important ways. First, responding to calls for research from de Reuver et al. (2018) and Schrieck et al. (2018), this study is one of the first to systematically and comprehensively investigate factors inhibiting MSP diffusion in highly competitive B2B networks. Previous research has predominantly focused on the bright side of platforms and has investigated diffusion-promoting factors mostly in B2C and occasionally in medium competitive B2B networks (Kembro et al. 2017). However, important aspects of the dark side of MSP diffusion, including core inhibiting factors, have only been treated superficially so far. Van Alstyne et al. (2016), for example, analyzed “6 Reasons for Platform Fail” and showed that failures such as “failure to share the surplus” or “failure to launch the right side” cause platforms to collapse. However, the complex interrelationships between multiple stakeholders interacting in highly competitive B2B networks have still not been addressed in the literature. Thus, our study extends the scarce literature on MSP diffusion by unraveling 21 core inhibiting factors, which specifically stem from interorganizational competition. Beyond detecting unique and consequential inhibitors in highly competitive B2B networks, our findings add to existing research by allowing scholars to integrate the identified inhibitors into established diffusion theories and frameworks, such as network economics or more holistic, process-oriented theories such as the theory of the net-enabled innovation business cycle by Wheeler (2002). The extension of these theories by our factors may substantially increase their explanatory and predictive validity.

Second, we also contribute to the research at the interface between platform and technology diffusion research. Network effects are a core element of MSP diffusion and

often determine the fate of MSPs for the better or worse. Previous research has only provided anecdotal evidence of the effects of inhibiting factors on network effects and has overlooked to examine their intricate interrelationships. We shed a nuanced light on the impact of inhibiting factors on same-side and cross-side network effects to better understand which factors exactly influence which type of network effects. In addition, we extend the prevailing categorization of network effects by adding mixed-side network effects, which covers factors influencing same- and cross-side network effects simultaneously. This knowledge may enable scholars to design studies on network effects more precisely. For example, by identifying and categorizing inhibiting factors, researchers are able to manipulate factors influencing cross-, same- or mixed-side network effects in an isolated or joint manner. In doing so, scholars can understand MSP diffusion on a deeper level.

Finally, our study also advances IOIS adoption research by revealing multilevel contextual factors (Kurnia et al. 2019) that have been neglected or overlooked so far. By answering the calls of Hong et al. (2013) and Te'eni (2015) for a stronger contextualization of IS studies, we looked at factors inhibiting the diffusion of MSPs as well as at the corresponding challenges that organizations face in highly competitive B2B networks. In doing so, we specifically took industry-specific and regulatory conditions into account and highlighted the importance of placing a spotlight on the interrelationships of these factors with network effects prevailing on MSPs. This is an important extension to previous IOIS adoption research that has largely limited its focus on inter- or intra-organizational factors to the neglect of industry-specific and regulatory requirements, which can have important implications for IOIS adoption (and MSP diffusion specifically) via their influence on network effects. In addition, by linking our results with the IOIS adoption literature we point out that these new insights can serve as a fruitful basis for further research in related IS research. Especially in the B2B context, MSPs constitute a subclass of IOIS in which several organizations participate. Based on this connection, we believe that our results are also relevant to other types of IOIS (e.g., SCM or ERP systems).

Our research also provides important insights for practitioners. Through the granular identification of codes, factors, and overarching themes, as well as the impact of factors on network effects, practitioners can develop interventions and countermeasures to

mitigate the inhibitors of MSP diffusion in highly competitive B2B networks. Moreover, by evaluating the relevance of our results, we provide a prioritization of the inhibitory factors so that practitioners are now able to address strong inhibitory factors first.

Notwithstanding these results, our study is subject to several limitations. We gathered our findings in a specific case, which means that these results are not generalizable. Although our research case represents the largest air cargo hub in Europe, smaller air cargo hubs or other transportation modes (e.g., sea freight) or even other business sectors should be analyzed with regard to the inhibiting factors. In addition to inhibiting factors, promoting factors and negative network effects in this, or other highly competitive B2B networks should be investigated in the future. Moreover, we determined our inhibiting factors through the qualitative analysis of interview data. To strengthen their external validity, they should be confirmed in quantitative studies. As such, these factors can serve as a springboard for further quantitative investigations of the diffusion of MSPs in highly competitive B2B networks.

In conclusion, this study uncovered crucial inhibiting factors and thus shed light on the dark side of MSP diffusion in highly competitive B2B networks. Moreover, we advanced our understanding of how and to what extent these inhibiting factors may affect cross- and same-side network effects on MSP that often determine the fate of platforms for better or worse. We hope that our study gives fresh impetus to fuel the stream of research on MSP diffusion and IOIS adoption in highly competitive B2B settings and helps practitioners to refine their knowledge about the most consequential factors inhibiting MSP diffusion.

4.7 Acknowledgement

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5 Trust-Building Influence of Technological Features on Users' Pre-adoption Behavior

Title: Trust-Building Effects of Blockchain Features – An Empirical Analysis of Immutability, Traceability and Anonymity

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Abstract

Alongside the hype regarding the cryptocurrency Bitcoin, the underlying blockchain technology is growing in popularity as well. The potential of this technology has been acknowledged by academic researchers and practitioners alike. Although research on blockchain technology has increased tremendously in recent years, scholars paid only a little attention to the crucial topic of trust in blockchain technology. To investigate trust in blockchain technology, previous research has predominantly used qualitative or design-oriented research approaches. Yet, empirical investigations of individual blockchain features have received only minimal attention so far. To fill this research gap, we conducted a scenario-based experimental study with 455 participants. We analyzed the trust-building effect of three technological features (immutability and traceability of information as well as an anonymous use of the technology), which can be found in current blockchain implementations. Our results show that immutability and traceability positively and anonymity negatively influence trust in technology. Moreover, anonymity moderates the effect of immutability, showing that in highly anonymous blockchains, the immutability of information is more relevant. By revealing the interplay between blockchain features and trust in technology, we broaden the discussion concerning the impact of trust in blockchain technology and open various new avenues for future research.

Keywords: Blockchain, Trust in technology, Anonymity, Distributed Ledger Technology

5.1 Introduction

Blockchain technology first attracted attention in 2008, when Bitcoin, a decentralized digital payment system, was introduced as peer-to-peer cryptocurrency (Yin et al. 2019). Thanks to Bitcoin, the blockchain technology has attracted much attention in both mainstream media and industry over the past ten years (Avital et al. 2016), particularly in the financial sector (Nærland et al. 2017). The considerable interest of the financial sector is due, among others, to the enormous price increases and the incomparable market capitalization of Bitcoin. According to Yin et al. (2019), for example, Bitcoin's market capitalization in 2018 was approximately more than 100 billion USD. But, more importantly, the rapid growth of Bitcoin led also to the rise of an ecosystem of innovative ideas and services that stretches far beyond the financial sector (Tapscott and Tapscott 2018). For instance, scholars state that blockchain technology has the potential to shake up supply chains or to prevent fraudulent tax returns (Du et al. 2019; Durach et al. 2020; Hyvärinen et al. 2017). Meanwhile, prototypical applications are increasingly being found in these areas as well. In the transportation sector, for instance, Maersk and IBM have developed the blockchain-based platform "TradeLense" to reduce bureaucracy within this sector, improve supply chain visibility and eliminate inefficiencies through paper-based processes (Scott 2018).

According to Beck et al. (2017, p. 381), a blockchain is "a distributed ledger technology in the form of a distributed transactional database, secured by cryptography, and governed by a consensus mechanism". In comparison to traditional centralized database architecture, blockchain technology offers unique features such as immutability of transactions, traceability of all entries, and anonymity of actors (Hughes et al. 2019; Wickboldt and Kliewer 2019). These features contribute to the fact that the blockchain is often regarded as a trust-free technology (Beck et al. 2016). However, other views argue, for example, that instead of an emergence of an actual trust-free technology, a shift from an institution-based trust to trust in technology occurs (e.g., Lustig and Nardi 2015).

Until today, theoretical issues such as adoption have been scrutinized to some extent (Abramova and Böhme 2016). However, the significance of trust in the blockchain context is yet to be analyzed in-depth, either conceptually or empirically (Sadhya et al. 2018). For example, nascent research results are the two-sided trust framework model

by Ostern (2018), which illustrates how factors foster or impede the formation of trust in blockchains or the work of Beck et al. (2016), which shows how a trust-based centralized system can be replaced by distributed and trust-free transaction systems. Previous work, however, does not address the influence on trust that emanates from three main features of blockchain technology, i.e., immutability, traceability and anonymity. In an interview-based study, Sas and Khairuddin (2017) were able to gain first insights and revealed that these features are related to trust in blockchain technology. However, scholars were not yet able to provide empirical evidence for this critical relationship. The empirical investigation of these features is essential since they are unique facets of the blockchain technology and occur in this specific constellation exclusively in blockchain technology. Unfortunately, previous results from traditional centralized database architecture cannot be transferred to blockchain research. One reason for this is that conventional systems with centralized storage of data do not possess the unique trust-related features (i.e., immutability, traceability and anonymity) of blockchain technology. Various calls for research underline the importance of empirical investigation of the influence of these blockchain features on trust. Rossi et al. (2019b), for instance, calls for a more granular, theory-driven, and empirically investigation of the relationship between trust and blockchain. Despite these calls for research, neither direct nor moderating influences of these blockchain features on trust in technology have been empirically investigated so far. This research gap leads to our research questions:

RQ 1) What is the impact of the blockchain technology features immutability, traceability, and anonymity on trust in technology?

RQ 2) How does anonymity interact with immutability and traceability?

To answer these research questions, we develop five hypotheses, which were tested in a scenario-based online experiment with 455 participants. For the operationalization of our features, we were guided by existing blockchain applications and ensured that these features are perceived similarly by our participants. In doing so, we were able to demonstrate that the blockchain features immutability and traceability have a positive impact on trust in technology. In contrast, the anonymous use of technology decreases trust in technology. However, even more, noteworthy is that by investigating the interactive effects of these blockchain features, we unveiled that immutability interacts

with anonymity: If individuals perceive that they are more identifiable, the feature immutability seems to be less relevant. In contrast, we found no empirical evidence for an interactive effect between anonymity and traceability.

By doing so, we contribute to existing research in several important ways: Firstly, our study is one of the first empirical studies which investigates the isolated as well as the combined effect of specific features of blockchain technology. In particular, we heed calls for research from Rossi et al. (2019b) and Beck et al. (2017) and extend the scarce literature on blockchain research by providing empirical evidence that specific blockchain features, namely immutability, traceability, and anonymity affect trust in technology. Secondly, in contrast to previous design science approaches used in research, we have decomposed the blockchain features and demonstrated their separate and moderating effect on trust in technology. The revealed interactive effect between these features (i.e., anonymity and immutability), indicates a substituting effect between primarily technological and social mechanisms mediated through technology regarding their impact on trust in technology. This insight contributes to a more nuanced and fine-grained understanding of trust-building in technologies in general and in the context of blockchains in particular. Our results provide vast opportunities for further research on blockchain protocols, as they can specifically strengthen features that increase trust in the technology. Thirdly, our results highlight the importance of considering the distinct features of technology regarding their effect on trust in that technology and thus provide insights on how other industries (e.g., supply chain management) can leverage these features to build trust in further industry-specific technologies.

The remainder of this paper is structured as follows. In the next section, we present the theoretical background with regards to users' perception of blockchain features and trust in technology. Afterward, we develop our hypotheses, followed by a description of our research methodology. Subsequently, we present our results. Finally, we discuss the results, draw theoretical and practical implications and present avenues for future research.

5.2 Theoretical Foundation

5.2.1 Trust-Building Features of Blockchain Technology

A blockchain is a distributed peer-to-peer ledger, which contains an ordered set of connected and replicated data blocks (Risius and Spohrer 2017). Thanks to the

technological design, a blockchain exhibits unique key features, such as immutability of transactions, traceability of all entries and anonymity of the actors (Ølnes et al. 2017). Each data blocks in a blockchain contain multiple transactions, a timestamp, the hash value of the previous block ("parent"), and a nonce, which is a random number for verifying the hash (Nofer et al. 2017). Hash values are unique, and fraud can be effectively prevented since changes of a block in the chain would immediately change the respective hash value (Nofer et al. 2017).

Moreover, new blocks can only be added at the end of the existing chain, if the majority of nodes in the network agree on both, the validity of transactions in a block and the validity of the block itself (Notheisen et al. 2017b). Thus, the integrity of the entire chain up to the first block (genesis block) is facilitated by hash value verification (Nofer et al. 2017). Therefore, once a block of data has been validated by the consensus mechanism and appended to the end of the blockchain, the containing transactions are nearly unchangeable.

However, there is no single specific form of blockchain technology. The technology exists in many different types, with various properties. The main variants are either private or public closed blockchains (called private/public permissioned blockchain) versus private or public open blockchains (called permissionless blockchain) (Mainelli and Smith 2015; Ølnes et al. 2017). Whether a ledger is public or private determines who has access to copies of the ledger, whereas the attribute of permissioned versus permissionless determines who maintains the ledger. Permissioned blockchains are controlled only by the owners, and they exclusively have the authority to provide access and assign new nodes to the blockchain architecture (Rossi et al. 2019b). It is important to note that these characteristics directly affect the perceived anonymity of users. In particular, when users are required to register and authenticate themselves to the owner of the blockchain (e.g., through a registration process in which the user's data is validated against their identity card), these users are very likely to assume that their actions can be traced back to them and that they cannot act anonymously when using the system. In contrast, when no identification is required, users probably presume that they remain anonymously while using technology.

In practice, the degree of anonymity varies when using blockchain systems. On the one hand, there are systems where users can act completely anonymously, e.g., payment

systems such as ZCash or Monero (Rossi et al. 2019a; Siegfried et al. 2020). Besides, there are also systems such as the well-known payment system Bitcoin allowing users to act pseudo-anonymously (Sas and Khairuddin 2017). Pseudo-anonymity means that the user's numeric wallet address is publicly available, but the owner's information is not available (Scott and Orlikowski 2014). On the other hand, there are also systems where the identity of the user is verified during registration, and therefore users are completely identifiable, e.g., applications for digital storage of patients' health records (McGhin et al. 2019; Roehrs et al. 2017).

The different designs of the technological properties affect not only the user's degree of anonymity but as well the degree of immutability and traceability of information from the user's perspective. The immutability of the transactions is visualized to the user in several ways. Firstly, for example, in Bitcoin transactions, users receive a post-purchase confirmation when the transaction is confirmed, and the block is successfully added to the chain. This status switches from unconfirmed to confirmed and is also visible to the user through various blockchain explorers (e.g., blockchain.com). In detail, the status unconfirmed indicates that the transaction has not yet been confirmed by the consensus mechanism meaning that no new block has been added at the end of the chain. In this case, the transaction can be replaced, for example, by using "replace by fee" or "double spending" (Pérez-Solà et al. 2019; Risius and Spohrer 2017).

In contrast, if the status is confirmed, the transaction and the block have been confirmed by the consensus mechanism and added at the end of the chain. Thus, this visualization provides a signal to the user that the data is nearly immutable stored in the blockchain. Secondly, in case of subsequent modification of the transaction data, the hash value of the block changes immediately, which is visible to the user (Nofer et al. 2017). This protection against subsequent modifications of information (i.e., immutability) is strengthened by the consensus mechanism as well as by the distribution of data storage.

The traceability of transaction data is supported by the included time stamps and the hash-link to the previous "parent" block. However, the possibility for users to perceive traceability is influenced by the chosen type of implementation (e.g., private vs. public). For example, in public blockchains, users can view the transaction data of each transaction (in the case of Bitcoin, for example, the sender, the recipient, and the amount) by using blockchain explorer software. Also, based on a single transaction, users

can identify the corresponding block and trace back all previous transactions (including transaction data) up to the genesis block (Nofer et al. 2017). In contrast, in private or permissioned blockchains, users' perception of the traceability feature is limited or even not possible at all.

5.2.2 Trust in Blockchain Technology

Trust is widely defined as “the willingness of a party to be vulnerable to the actions of another based on the expectation that the other party will perform a particular action important to the trustor, irrespective of the ability to monitor or control that other party” (Mayer et al. 1995, p. 772). By investigating trust between individuals and technology, IS researches have applied this general notion of trust relationships to the technological domain (e.g., McKnight et al. 2002). In the course of this investigation, trust in technology has been identified as a crucial factor influencing the adoption of several technologies, which has been studied extensively (e.g., Benbasat and Wang 2005; McKnight et al. 2002).

Trust in technology is primarily built similarly to trust in people (McKnight 2005). Both, a person as well as a technology, have the quality of competence in terms of what they can do. The perception of the quality of competence of another person or technology can be described as a trusting belief McKnight (2005). In detail, trusting belief in a person's competence means that the person is perceived as capable of performing a task or assuming responsibility. For the conceptualization of trust in technology, IS researcher distinguishes between two streams (e.g., Lankton et al. 2015; Ostern 2018). In the first stream, trust in technology is perceived as human-like, and computers are seen as social actors (Nass and Moon 2000). The measures use attributes that are also used for the evaluation of trust between individuals – typically the trusting belief dimensions integrity, competence, and benevolence (Li et al. 2008; Vance et al. 2008). Integrity is the trustor's perception that the trustee adheres to a set of principles that the trustor finds acceptable (Mayer et al. 1995). Competence is understood as the set of skills, competencies, and characteristics that enable a party to influence within a specific domain (Mayer et al. 1995). Benevolence means that the trustee is caring and acts in the interest of the trustor (Li et al. 2006). These measures are mainly used when the addressed technology has anthropomorphic properties or interactive functions, such as

online recommendation systems with human characteristics or social media websites (Benbasat and Wang 2005; Benlian et al. 2019; Lankton and McKnight 2011).

In the second stream, trust in technology is conceptualized as machine-like trust and measured with modified attributes. In this context, McKnight et al. (2011) developed the measures reliability, functionality, and helpfulness. These measures are derived from the trusting belief dimensions integrity, competence, and benevolence. They are transferred into the technological environment by mapping these three dimensions to the modified dimensions of reliability, functionality, and helpfulness (Lankton and McKnight 2011). According to McKnight (2005), reliability corresponds to integrity and is characterized by error-free and proper service of technology. Functionality (corresponding to competence) describes the perception of the technology to have the necessary functionality to perform a task that the trustor wants to be done (McKnight 2005). Helpfulness (corresponding to benevolence) is used to evaluate adequate help provided by the technology or the system (McKnight et al. 2011). The measures of this stream are appropriate when the technology has merely technical features, such as in the case of knowledge management systems (Thatcher et al. 2011). However, depending on the subject under investigation, it must be examined which approach is appropriate. In the case of blockchain, Ostern (2018) recommends using elements of both streams to measure trust in technology, as the technology allows interactive functions between individuals which are mediated through the blockchain technology. In detail, Bitcoin transactions, for example, are based strictly on technical features such as immutability or traceability of information, but also include components of human interaction. To capture both, machine-like and human-like trust in technology, IS researcher combined trusting belief dimension of both domains, mainly when the technology provides human and technological characteristics (e.g., Lankton et al. 2015; Lankton and McKnight 2008; Lee and Turban 2001). By doing so, Lee and Turban (2001), for instance, have captured the trust dimension competence in the human-like domain alongside reliability in the machine-like domain. With this approach, they measure both, trust in the seller mediated by the technology (i.e., the e-commerce website) and trust in the technology itself. Both, the interaction with the blockchain technology as well as trading in e-commerce represents an interaction between humans, which is mediated by technology. Thus, the established procedures can be adapted to this new context.

Although scholars attest the blockchain technology an enormous potential (e.g., Beck et al. 2018; Ølnes et al. 2017; Zachariadis et al. 2019), research on blockchain and especially on trust in blockchain is still in its infancy. Until today, the AIS Senior Scholars' Basket contains only a few publications investigating blockchain technology. Moreover, these publications date back only a couple of years and are thematically broadly diversified. In more detail, Mai et al. (2018), for example, focused on the impact of social media on the Bitcoin stock value, and Ingram Bogusz and Morisse (2018) have investigated the conflict arising from the commercialization of open source technologies in the example of blockchain technology. Furthermore, Du et al. (2019) conducted a case study about a successful blockchain implementation and Beck et al. (2018) as well as Yin et al. (2019), for instance, developed a research agenda for future directions of blockchain research. None of the publications we identified from the basket examined a direct relationship between the features of blockchain technology and trust in technology. However, the high relevance of investigating this relationship for the IS research community is evident from several calls for research contained in these publications (e.g., Beck et al. 2018; Mai et al. 2018; Rossi et al. 2019b). Besides this, leading IS conferences (e.g., European Conference on Information Systems or International Conference on Information Systems) have dealt with this topic for some time. Thematically many publications are practically motivated and investigate challenges associated with conceivable use cases, improvements of the implementation of blockchain protocols, smart contracts, as well as of security, privacy and usability of blockchain applications (e.g., Beck et al. 2016; Egelund-Müller et al. 2017; Notheisen et al. 2017a; Risius and Spohrer 2017). Furthermore, several publications consider financial issues such as Bitcoins (e.g., Abramova and Böhme 2016), Initial Coin Offerings (e.g., Chanson et al. 2018) or challenges for governance and organizations arising from that technology (e.g., Seebacher and Schüritz 2019).

In addition to the topics above, trust in blockchain technology is recently getting increased attention at these conferences. Jahanbin et al. (2019), for instance, investigated the individual trust requirements and priorities of supply chain participants using blockchain technology. Moreover, Beck et al. (2016), illustrate how a trust-based centralized system can be replaced by a distributed and trust-free transaction system. Methodically, many projects in blockchain research pursued a design science approach and developed extensive prototypes (e.g., Jahanbin et al. 2019). In these design-oriented

studies, requirements for the application were defined during the development phase, but individual technological features of the blockchain technology were not experimentally varied and evaluated. Moreover, other projects have pursued qualitative approaches and discussed, for example, the influence of trust in blockchain on blockchain adoption (e.g., Sadhya and Sadhya 2018; Sas and Khairuddin 2015). An experimental and empirical investigation of the influences of specific blockchain features on trust in technology has, to the best of our knowledge, been overlooked so far in previous research.

5.3 Hypotheses Development

According to McKnight (2005), individuals trusting beliefs in another person will be increased if they consider the characteristics of the other person as beneficial for the performance of a task. Transferred to a technology, favorable characteristics of technology (for the performance of the task) will influence trusting beliefs in this technology. Such a beneficial characteristic of technology is the preservation of data integrity resulting from the technological design (Nicolaou and McKnight 2006). A facet of data integrity is the prevention of unauthorized changes in information (Birgisson et al. 2010). The characteristics of blockchain technology prevent a subsequent change of data due to the design of the technology. In previous IS literature, data integrity is integrated into the concept of information quality. The positive relationship between trust in technology and (perceived) information quality has already been demonstrated, for example, in the case of supply chain information systems (e.g., Nicolaou and McKnight 2006). Traditional supply chain information systems serve, among other things, for the exchange of information (McKnight et al. 2017; Nicolaou et al. 2013). Unlike blockchain technology, these systems cannot guarantee comprehensive protection against subsequent or malicious alteration of information based on their technological basis.

Nevertheless, these traditional information exchange systems are able to provide a certain degree of information quality that is sufficient to build trust in the technology. The blockchain technology prevents a subsequent or malicious manipulation of information due to the technological design. Therefore, we assume that if users perceive that the technology does not allow information to be changed afterward, this will further increase trust in the technology. This leads to our first hypothesis:

H1: The stronger users perceive that blockchain technology enables immutability of information, the higher is their trust in that technology.

Traceability refers to the ability to track the history of entities (Aiello et al. 2015; Moe 1998; Olsen and Borit 2013). Entities can be physical goods such as food (Gellynck and Verbeke 2001) or high-value products such as diamonds (Maurer 2017) or pharmaceuticals (Rotunno et al. 2014). Nevertheless, entities can also be non-physical objects such as processes (Olsen and Borit 2013), transactions of cryptocurrencies (Vasek et al. 2014), or information changes (Khattak et al. 2008). Usually, traceability is managed by traceability systems (Moe 1998; Olsen and Borit 2013). These systems have already been extensively investigated in IS research with a focus on reducing user uncertainty (e.g., Chen and Huang 2013; Choe et al. 2009). In particular, the results of Liang et al. (2005) indicate that reducing perceived uncertainty is a way to build trust. Moreover, according to Chang and Chen (2008) and Pavlou (2003), low behavioral or environmental uncertainty leads to higher trust. Taken together, since traceability has been demonstrated to reduce uncertainty and reduced uncertainty leads to higher trust, traceability should lead to higher trust. Due to its technological properties, the blockchain is considered as a suitable technology for traceability systems (e.g., Hald and Kinra 2019; Helo and Hao 2019; Lacity 2018). Scholars point out that the blockchain technology should generate trust due to the traceability of all transactions (Abeyratne and Monfared 2016; Wickboldt and Kliewer 2019). However, these statements have not yet been empirically investigated. Based on these reasonings, we hypothesize:

H2: The stronger users perceive that blockchain technology enables traceability of information, the higher is their trust in that technology.

Public blockchains, such as Bitcoin's, enables an almost anonymous use of technology. On the one hand, anonymous use of technology offers advantages, such as privacy protection by protecting confidential information from untrusted platforms and parties (Brazier et al. 2004). On the other hand, the anonymous use of technology also enables malicious or criminal actions. In the case of Bitcoin, recently, various alarming or criminal actions have been reported. For example, Bitcoin was used for transaction processing on the website Silk Road, a website that facilitates the sale of illicit drugs (Martin 2014). Some other publications report that Bitcoin has been used for terror

financing, thefts, scams, and ransomware (Foley et al. 2018; Hyvärinen et al. 2017; Martin 2014).

Crime, made possible by the anonymous use of technology, is not only an issue for law enforcement authorities but also prompts users to perceive the technology as less trustworthy (Yin et al. 2019). Furthermore, in the context of social media, for example, anonymity is often misused to create an environment for hate speech and defamatory remarks from people who behave with impunity and irresponsibility (Scott and Orlikowski 2014). Davenport (2002) reports that anonymous communications on the Internet in forms of criminal and anti-social behavior causes loss of trust and annual damages in billions of USD. In contrast, (Mesch 2012) was able to show that online trust increases when personally identifiable information is disclosed. In addition, Sas and Khairuddin (2017) point out that the regulated online exchange is the preferred form of transaction, as the regulation promotes users' trust. They point out that Bitcoin users prefer transactions with identifiable authorized traders, which implies that identifiability constitutes a critical factor in establishing credibility and trust.

These results are in line with the accountability theory. According to (Vance et al. 2015, p. 350), the "theory explains how the perceived need to justify one's behaviors to another party causes one to consider and feel accountable for the process by which decisions and judgments have been reached". Furthermore, Fandt and Ferris (1990) point out that the accountability theory also explains how to increase prosocial behaviors, which, for example, facilitate trust (Ammeter et al. 2004; Tetlock 1985). A core requirement of the accountability theory is the identifiability of persons (Vance et al. 2015). When people are identifiable, they feel the need to consider the possible outcome in a decision-making process. This need increases the likelihood that a person will think deeply and systematically about his or her procedural behaviors to consider his or her actions (Vance et al. 2013). This is an explanation that if individuals are identifiable, they are less prone to criminal activity or deviant behavior. However, this also means that if persons are not identifiable, these mechanisms are not available, and thus, the likelihood of inappropriate actions or socially undesirable and deviant behavior increases. Based on these reasons, we assume that if a technology does not allow the identification of individuals, the likelihood of inappropriate actions increases, and therefore, the technology will be considered less trustworthy. Thus, we hypothesize:

H3: The stronger users perceive that blockchain technology allows them to remain anonymous during use, the lower is their trust in that technology.

Furthermore, we assume that if technology allows an almost anonymous use, technical characteristics of this technology gain in importance. Therefore, we assume an interaction between an anonymous use of technology and the protection against information alteration by the technology. Vance et al. (2013) demonstrated that an increasing degree of identifiability reduces the violation of IS access policies by users. Identifiability causes that an individual knows that his or her actions can be traced back to him or her (Vance et al. 2013). Thus, an individual knows that he or she can be made responsible for those actions (Lerner and Tetlock 1999). When individuals perform identifiable behaviors, it is more likely that they will only perform behaviors for which they are willing to assume responsibility (Vance et al. 2013). Transferred to alterations of information, this means that if individuals are identifiable, they will not subsequently change any information unauthorized, as they could be held responsible for this access violating behavior. Thus, when technology requires identification, the likelihood of individuals altering information without authorization is lower, resulting in a loss of relevance of protection against subsequent alterations of information. In contrast, if the technology allows anonymous use, users' relevance of protection against subsequent alterations of information increases, which influence its effect on trust in the technology.

H4: The stronger users perceive that blockchain technology allows them to remain anonymous during use, the higher is the trust-building effect of immutability.

Finally, we also assume an interaction effect between anonymous technology use and the traceability of information. When technology allows users to remain anonymous, the potential risk increases that these or other users will make unauthorized changes to information. This also implies that the probability of incorrect information being contained in the application increases. To track possible errors in the information, individuals are dependent on detailed and traceable information (Choe et al. 2009). Since the probability of changed information is higher in the case of anonymous technology use, the relevance of traceability of information increases. This leads to our last hypothesis:

H5: The stronger users perceive that blockchain technology allows them to remain anonymous during use, the higher is the trust-building effect of traceability.

To generate a clear picture of our postulated effects, we summarize our hypothesis in Figure 22.

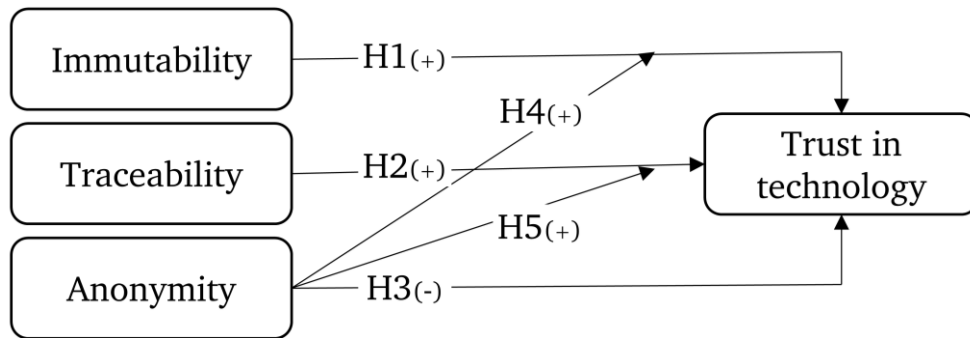


Figure 22: Research model.

5.4 Research Methodology

5.4.1 Experimental Design and Treatments

Following previous scenario-based experimental research (e.g., Klumpe et al. 2018; Schneider et al. 2019), we performed a 2 (immutability: absent vs. present) x 2 (traceability: absent vs. present) x 2 (anonymity: absent vs. present) full factorial, scenario-based experiment to investigate the effects of blockchain features. The design results in eight different groups. We randomly assigned our participants to one of these eight groups. We chose the management of language certificate as a suitable scenario because it constitutes an uncomplicated and comprehensible use case, which fulfills the requirements for a suitable blockchain use case - decentralized environments and limited trust (Lindman et al. 2017; Ølnes et al. 2017). Since the term blockchain is strongly hyped as "trust machine" (Betz Wieser et al. 2019), we deliberately did not mention the term in our experiment. In doing so, we avoided that the term blockchain causes signaling effects similar to security certificates on websites (e.g., Wells et al. 2011).

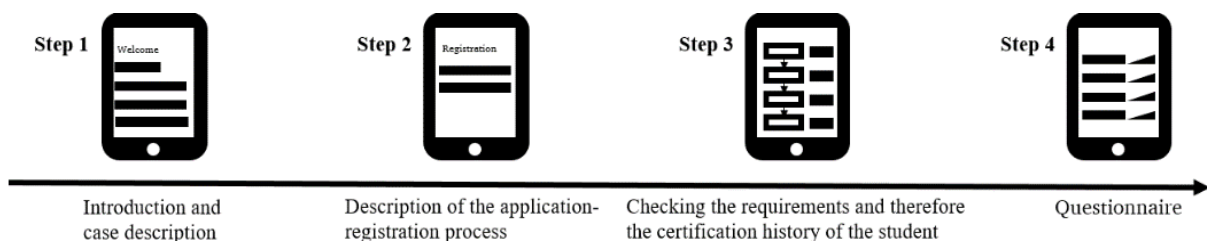


Figure 23: Experimental sequence.

Similar to previous experimental procedures (Adam et al. 2020; Koch and Benlian 2017; Röthke et al. 2020), our study was carried out in multiple consecutive steps (see Figure 23). First, in the introduction, we described our scenario. We asked our participants to put themselves in the shoes of an English teacher. Their job was to check whether an unknown student named Tom meets the requirements to participate in the language course “English level 4”. To fulfill this task, our participants had to register in the fictitious mobile application “MyLanguageCertification” and afterward check the certificates with it. In step 2, we performed our first manipulation in which our participants had to register in the mobile application. For this purpose, we first showed our participants a typical registration page of a mobile application. Subsequently, depending on the assigned group, we informed our participants that either their registration information would be verified by a third party (i.e., by a Video-Ident-Provider) before using the app (anonymity absent), or that no verification of the registration information would take place (anonymity present). The two different processes serve for the operationalization of anonymity and representing a login to a private blockchain (a central authority decides about participation and knows the user) or to a public blockchain (everyone can participate anonymously). Afterward, in step 3, we performed our next manipulations. Also, depending on the initially assigned group, we presented our participants one of the four different representations of the app. We operationalized the immutability of information by displaying the student’s certificates as not editable (“Certificate not editable”) or editable (“Edit certificate”) (compare Figure 24, screenshots 3 and 4). We have operationalized the traceability by showing the status “completed” or “unknown” in the student’s certificates Level 1 and Level 2 (compare Figure 24, screenshots 1 and 2). Also, we again showed our participants their task next to the illustration. Their task was to verify that the student Tom has completed all previous language courses (Level 1 to 3). In step 4, the last step, our participants had to complete a survey.

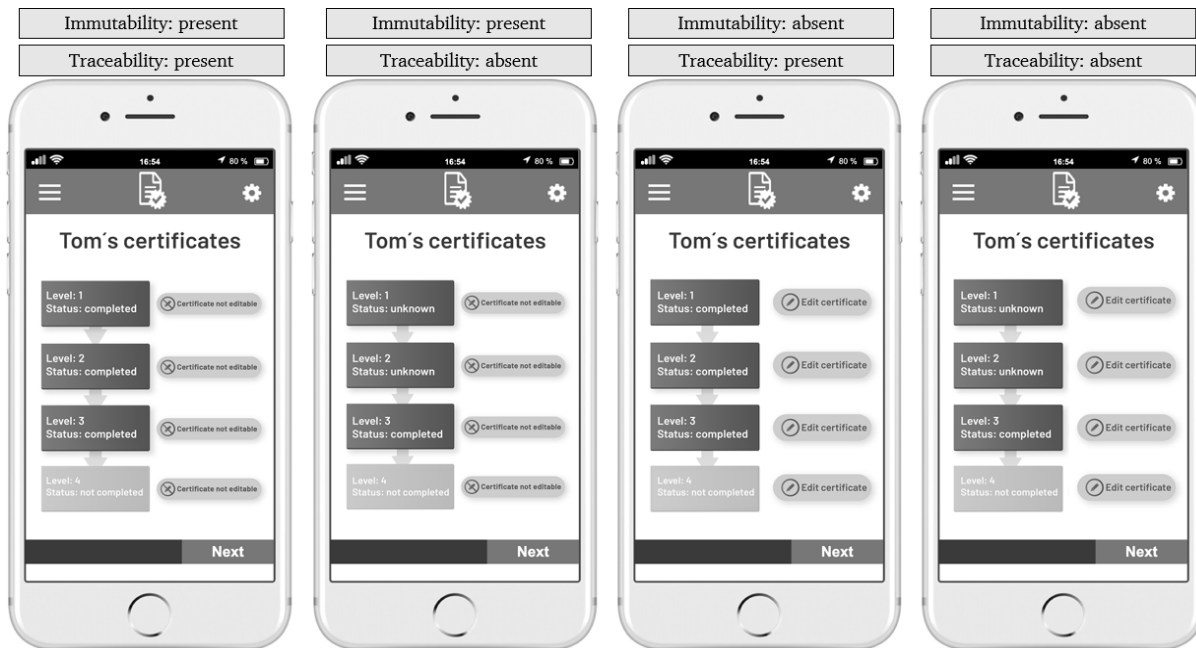


Figure 24: Certification screen for the different groups.

5.4.2 Manipulation Checks and Measurement Validation

The dependent variable, trust in technology, was measured by using reliability and competence constructs from Lankton et al. (2015). We did not consider the third dimension of human-like (benevolence), respectively, machine-like (helpfulness) trust, as the application has no help function. However, the participants were supported by the instruction description in their tasks. Furthermore, the manipulations were tested by measuring perceived immutability (Flavián and Guinalú 2006), perceived traceability (self-developed) and perceived anonymity (Ayyagari et al. 2011) in different groups. To preserve the realism of the study, we have slightly adjusted our items (see appendix) and adapted them to the context of the study (e.g., replacing the original application name “Excel“ with ”MyLanguageCertification“).

By evaluating our manipulation checks, we confirm that perceived anonymity was higher when our anonymity manipulation was present ($M = 5.64$; $SD = 1.96$) than when it was absent ($M = 3.99$; $SD = 2.15$; $F(1,453) = 150.33$; $p < .001$). Similarly, our manipulation check for immutability demonstrated that the perceived immutability was higher when the displayed certificate was immutable ($M = 5.39$; $SD = 2.09$) compared to when it was mutable ($M = 3.57$; $SD = 3.17$; $F(1,453) = 143.77$; $p < .001$). Further, we could validate that perceived traceability was higher when our traceability manipulation was present ($M = 5.24$; $SD = 1.79$) compared to when it was absent (M

=4.48; SD = 2.34; $F(1,453) = 32.62$; $p < .001$). In addition to the measurements listed so far, we have included age, gender, job, education, institution-based trust (Vance et al. 2008), disposition to trust (Gefen and Straub 2004), and product knowledge (Qiu and Benbasat 2010) as control variables. For our constructs, the reliability was measured by using Cronbach alpha, composite reliability (CR), and average variance extracted (AVE). The alphas of the constructs had a value above 0.7, which is a proper value. The CR of all constructs was above 0.5, which is also a satisfying value. The AVE met the requirements for a suitable level of reliability as well (Fornell and Larcker 1981). To address common method bias, we followed the recommendations of Podsakoff et al. (2003): Firstly, we noted that participants should answer honestly and that there are no right and wrong answers. Secondly, we guaranteed anonymity for the evaluation. Thirdly, we used different answer formats.

5.5 Analysis and Results

5.5.1 Descriptive Statistics

We acquired our participants via the panel provider Prolific. Prolific participants received 0.99 euros as compensation for their effort. In contrast to Amazon M-Turk, Prolific offers services that explicitly targeted to researchers. Prolific participants know that they will be recruited to participate in the research. They are informed about the expected payments, treatments (e.g., exclusion due to faulty manipulation checks), rights, and obligations in such an environment (Palan and Schitter 2018). Furthermore, Prolific offers a comprehensive pre-filtering service, so that we were able to limit the group of possible participants to English native speakers from Great Britain.

To evaluate our research design, we conducted a pretest with 80 participants prior to the final experiment. The results revealed that participants considered our scenario as realistic, our manipulation checks, as well as participants' feedback, indicated that the treatment worked as we intended. Thus, we left our experimental design unchanged for the final experiment. In sum, 477 participants completed our study, and 455 participants were considered in the final analysis. We excluded 22 participants due to incomplete information or failed attention checks. The average age of our participants was 35.1 years, and 64 % were female, 34 % male, and 2 % reported others. 44 % have a university degree as the highest education level, 16 % an A level, and 40 % reported other educational qualifications. The distribution of the current job-activities showed that 71 %

of all participants were employed or self-employed, 9 % were students, and 20 % reported another activity. Moreover, our dependent and control variables show the following values: Trust in Technology ($M = 4.83$, $SD = 1.69$); Product Knowledge ($M = 3.99$, $SD = 0.39$); Disposition to Trust ($M = 4.81$, $SD = 1.69$); Institution-based Trust situational normality: Competence ($M = 5.02$, $SD = 1.20$), Benevolence ($M = 4.64$, $SD = 1.56$), Integrity ($M = 4.67$, $SD = 1.49$).

5.5.2 Main and Moderation Effects

To test our hypotheses, we conducted a two-stage hierarchical linear regression on our dependent variable trust in technology (see Table 6). We coded the manipulations immutability, traceability, and anonymity as dummy variables (respective manipulation is present = 1 / is absent = 0).

	Stage 1		Stage 2	
	Coef.	SE.	Coef.	SE.
Intercept	-2.27***	.53	2.73***	.53
Manipulations				
Anonymity	-.53***	.11	-.79***	.16
Immutability	.23*	.11	.02	.15
Traceability	.56***	.11	.55***	.14
Immutability x Anonymity	-	-	.46*	.22
Traceability x Anonymity	-	-	.04	.22
Controls				
Product Knowledge	.10	.09	.10	.09
Disposition to Trust	.02	.04	.01	.04
Institution-based Trust Situational Normality				
- Competence	.15	.09	.16	.09
- Benevolence	.16	.09	.15	.09
- Integrity	.09	.08	.10	.08
Demographics				
Age	-.09	.05	-.08	.05
Gender (male)	-.06	.05	-.04	.11
Job	-.02	.03	-.03	.03
Education	-.05	.04	-.04	.03
Model Fit				
R ²		.266		.274
Adjusted R ²		.246		.250

Note: * $p < .05$; ** $p < .01$; *** $p < .001$; $N = 455$; Coef. = Coefficient; SE. = Standard Error

Table 6: Two stages hierarchical OLS regression on trust in technology.

In stage 1, we entered all control variables as well as our independent variables, anonymity, immutability, and traceability. In stage 2, we added the interaction term of immutability and anonymity. R^2 and adjusted R^2 were computed to test the fit of both stages. By adding our manipulations into the measurement model, the share of explained variance increases from 15 % to 25 %. Regarding the controls, none of these variables had a significant effect on trust in technology.

The results of stage 1 demonstrate significant positive main effects of immutability ($b = .23$; $t\text{-statistic} = 2.1$; $p < .05$) and traceability ($b = .56$; $t\text{-statistic} = 5.2$; $p < .001$) on trust in technology and a significant negative main effect of anonymity ($b = -.52$; $t\text{-statistic} = -4.7$; $p < .001$) on trust in technology. Furthermore, supporting H1, in the condition where the displayed certificate was not editable and thus immutable, participants exhibited a higher level of trust in technology than when the certificate was mutable ($M = 4.98$ vs. 4.64 ; $SD = 1.83$ vs. 1.53 ; $F(1,453) = 7.86$; $p < 0.01$). Likewise, in treatments where the history of information was traceable, participants exhibited a higher level of trust in technology than when the history was not traceable, supporting H2 ($M = 5.11$ vs. 4.53 ; $SD = 1.42$ vs. 1.81 ; $F(1,453) = 23.76$; $p < 0.001$). Additionally, supporting H3, in the condition where the app could be used anonymously participants exhibited a lower level of trust in technology than in the condition with mandatory identification ($M = 4.49$ vs. 5.09 ; $SD = 1.41$ vs. 1.85 ; $F(1,453) = 25.09$; $p < 0.001$). Thus, all hypotheses (H1- H3) for the distinct effects of the blockchain features (i.e., immutability, traceability and anonymity) are supported empirically. The analysis in stage 2 unveils a significant two-way interaction of immutability and anonymity ($b = .46$; $t\text{-statistic} = 2.1$; $p < .05$) on trust in technology. In support of H4, the positive interaction term suggests that the effect of immutability on trust in technology is augmented when users perceive an anonymous usage of the technology.

As depicted in Figure 25, our results highlight that when users remain anonymous, users exhibited an increased trust in technology when the information was also immutable ($M = 4.75$; $SD = 1.60$). Yet, when the information was mutable the values were significantly lower ($M = 4.24$; $SD = 1.97$; $F(1,200) = 7.33$; $p < .001$). However, a significant difference in trust in technology between the treatments immutable and mutable does not emerge when app users perceive an identifiable use of the technology ($M = 5.13$ vs. 5.04 ; $SD = 1.44$ vs. 1.37 ; $F(1,251) = .31$; $p > .05$). Based on these results, we accept H4.

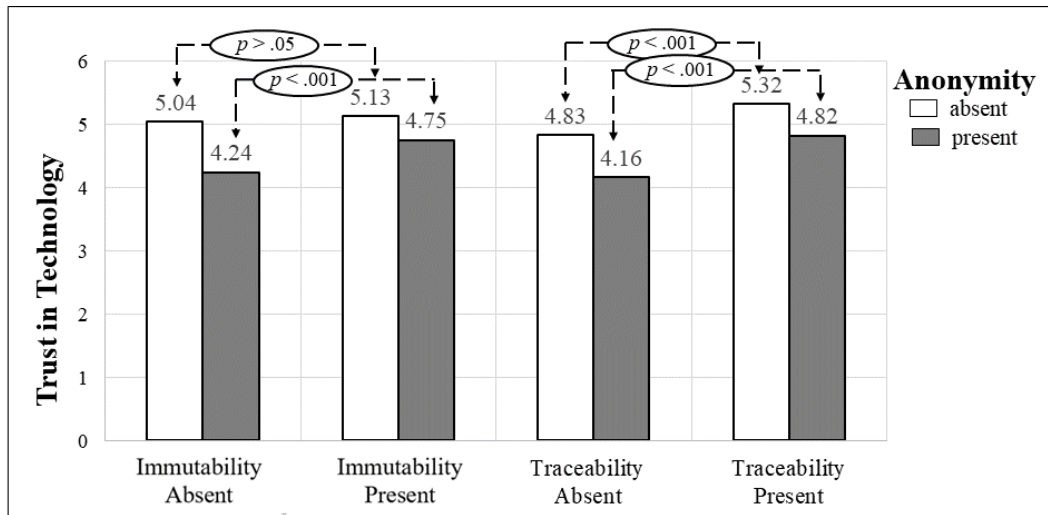


Figure 25: Contrast analysis for the different groups.

In contrast, our results do not indicate any significant interaction between traceability and anonymity ($b = .04$; t -statistic = .17; $p > .1$). As exhibited in Figure 25 too, when users remain anonymous, users exhibited an increased trust in technology when the information was also traceable ($M = 4.82$; $SD = 1.55$). However, when the information was not traceable the values were also significantly lower ($M = 4.16$; $SD = 1.94$; $F(1,200) = 12.53$; $p < .001$). Regarding H5, the difference in trust in technology between the treatments traceable and untraceable were significant, when app users were identifiable ($M = 5.32$ vs. 4.83 ; $SD = 1.22$ vs. 1.51 ; $F(1,251) = 11.19$; $p < .001$). Thus, we reject H5. Finally, we performed further robustness checks by replacing all treatment variables with the measured manipulation check constructs. The results yield the same signs for all regression coefficients, including the interaction effect.

5.6 Discussion, Implications and Future Research

This study aimed to examine and reveal how specific features of blockchain technology, namely immutability, traceability, and anonymity, affect users' trust in technology. The features immutability and traceability can be seen as blockchain specific trust-building features, comparable to trust-building features such as third party certificates for websites (Kim and Benbasat 2003) or restricted access rights for smart products (Michler et al. 2019). In contrast, a higher perceived degree of the anonymous use of blockchain technology impacts negatively trust in technology. Besides, we were able to demonstrate that anonymity interacts with immutability. If users perceive that technology allows anonymous usage, the immutability of information is more critical. In contrast, when technology requires an identification of the user, the importance of the immutability of

information will be less relevant. As a result, the trust-building effect of immutability is no longer supported by our analysis. However, our data showed no interaction between the traceability of information and the anonymous use of technology. This indicates that the trust-building influence of traceability exists independently of the perceived degree of the anonymous use of blockchain technology. Besides, it is notable that our model fit is rather low. However, considering the improvement between models 1 and 2, our models explain a significant portion of the total variance of our dependent variable trust in technology.

With our results, we contribute to research in several ways. Our study is one of the first empirical studies in blockchain research, which investigates the effects of selected blockchain features in an isolated manner. We have built on previous results from qualitative research and have empirically demonstrated the impact of the blockchain features immutability, traceability, and anonymity on trust in technology. Our results show that the designation of blockchain technology as "trust-free-technology" is misleading and, more specifically, that these three blockchain features are capable to influence trust in technology. It is well known from various other IS research areas that trust in technology is an important factor influencing the success of IS or the adoption of IS (e.g., Lee and See 2004; Moore and Benbasat 1991). Our results indicate that the role of trust must also be considered in future blockchain studies.

In addition, we decomposed the blockchain features, and empirically investigated their individual influence on trust in technology. Besides qualitative studies, previous research in the field of blockchain has often used design-oriented approaches. With this, individual blockchain features were not considered separately, but often the prototypical development as a whole. Our decomposed analysis of blockchain features allowed us to gain granular insights into the extent to which of the three features considered to promote or inhibit trust in technology. These findings are essential for further research on blockchain protocols, as they can specifically strengthen features that increase trust in technology.

Moreover, we were able to show that different blockchain features interact with each other, and their trust-building influence changes. In particular, we revealed an interaction between an anonymous use of technology and the immutability of information. The moderating influence of anonymity is relevant for two reasons: Firstly,

when users perceive that they are identifiable when using technology, moderation becomes evident, and the immutability of information loses importance. This means that the existing research on blockchains, especially those where users perceive that they do not act anonymously while using the technology, should be re-evaluated concerning this aspect, and further research in this stream should take this moderating effect into account. Secondly, this effect shows an interplay between technological and social control. When users perceive that they remain anonymous in their use of technology, it seems that users tend to rely on technological measures, such as the immutability of information, to build trust. In contrast, if users perceive that they are identifiable when using technology, the immutability of information seems to be less relevant. Thus, during the use of technology, users seem to be subject to a kind of social control, which is also in line with the accountability theory.

Furthermore, our results stimulate additional research areas, such as supply chain management. Traceability of information or objects is a central function in supply chain management. We were able to demonstrate that traceability is an essential part of trust-building in technology. This knowledge can be applied by researchers in the area of supply chain management, and additional specific features can be investigated which promote or inhibit trust in technology in this area. Finally, we heed various calls for research in the field of blockchain research. This includes calls for research from various research agendas such as Rossi et al. (2019b) or Beck et al. (2018) as well as from publications such as Hughes et al. (2019) who claims that, for example, questions on the legality of transactions or trust in technology should be investigated.

In addition to the theoretical contributions, our study also offers significant contributions to practitioners. Our results indicate that our considered blockchain features can influence users' trust in technology. Therefore, practitioners should ensure that users perceive features such as traceability or immutability of information, even if this is not necessary for the technical function of the application. Furthermore, we have shown that anonymity reduces trust in technology. Since the specific implementation of the technology can influence the degree of anonymity, practitioners should consider this aspect when choosing which type of blockchain to implement.

Our study offers broad avenues for further research but is also subject to some limitations. First of all, our study is a scenario-based experiment in which the

manipulations were carried out using a textual description and exemplary illustrations. Although the used method was appropriate for the context of our study, and our postulated hypotheses could be demonstrated empirically, some limitations of the scenario method should be explained in more detail. In our study, we asked the participants to take the perspective of a fictitious person and to perform a task from this point of view. This procedure is often used in IS research (e.g., Lowry et al. 2013; Vance et al. 2013; Wallbach and Haag 2018) but there may still be a difference between the real behavior of the participants and the given behavior in the role of the fictional person. During the study, we recorded an open feedback field in which many participants wrote that the study was very realistic. Based on these, we deem our scenarios and manipulations as realistic. However, we recommend validating the results in future, especially in the field or with a more heterogeneous and global distribution of the sample. Moreover, in our scenario, we have operationalized the technical features of blockchain technology via the user interface. This type of visualization is also found in various blockchain applications but is not always mandatory. Therefore, it should be noted that our results describe the effect of the perceived technical features on users' trust in technology. Besides, we only investigated three blockchain-specific features in our study. Further research is needed to investigate to what extent additional blockchain features such as the distributed ledger property, consensus mechanism, or open-source availability also influence trust in blockchain technology. Finally, depending on the specific implementation of blockchain technology, different levels of anonymity between the two extreme “anonymous” and “identifiable” will occur. Thus, the question arises, to which “degree of anonymity” the interaction effects between anonymity and immutability can be observed and whether linear or non-linear relationships can be expected. Furthermore, the question arises which of the above-mentioned blockchain features interact with anonymity or with other blockchain features, too.

5.7 Appendix

Trusting Belief-Specific Technology—Reliability (Lankton et al. 2015)
MyLanguageCertification is a very reliable piece of software.
MyLanguageCertification is extremely dependable.
MyLanguageCertification does not malfunction for me.
Trusting Belief-Specific Technology—Competence (Lankton et al. 2015)
MyLanguageCertification is competent and effective in managing language certificates.
MyLanguageCertification performs its role of managing language certificates very well.
Overall, MyLanguageCertification is a capable and proficient service for managing language certificates.
Immutability (Flavián and Guinalú 2006) “I think the app has sufficient technical capacity to ensure that the certificate details cannot be ...”
... easily modified by the user (Tom).
... easily modified by any other user.
... easily modified by a third party (e.g., by another teacher, provider).
Traceability (Self-developed)
MyLanguageCertification offers a complete and seamless documentation of language certificates.
I can easily check Tom's complete and seamless certification level in the application.
I can easily verify Tom's entire certificate history.
Anonymity (Ayyagari et al. 2011)
I can remain completely anonymous when using MyLanguageCertification.
I can use fictitious personal data (not my true personal data) when registering in MyLanguageCertification.
The personal data (e.g., name, driving licence number) provided by users when registering in MyLanguageCertification is consistent with their real personal data. (reverse)
We measured our Items by using 7-point Likert scales from strongly disagree (1) to strongly agree (7).

Table 7: Overview of the constructs and items used in the study.

6 Effects of Causal Attributions on Users' Post-adoption Behavior

Title: Who Is to Blame? How Too Much Information Threatens Users' Continuance Intention – An Experimental Analysis

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Abstract

The rapid innovation and spread of smartphones, as well as their mobile applications, offer people many benefits in their everyday life. The dark side, however, is that users are constantly facing more and more information, which may result in information overload. In this paper, we argue that information overload can affect users' continuance intention of mobile applications use. The context of smartphones and mobile applications needs special consideration because of the smaller display size and the touch-based user interface. In addition, we contend that these effects differ according to users' attribution of the blame (themselves or mobile application) for the information overload. To explore this effect, we build on and contextualize Bhattacharjee's information system continuance model and extend it with the construct information overload. We test the model by using a scenario-based study with 120 participants that enable us to manipulate information overload as well as the locus of the attribution of blame in an isolated way. The results show that satisfaction and perceived usefulness fully mediate the negative effect of information overload on continuance intention of mobile applications. Furthermore, internal attributions of blame are associated with a higher continuance intention than external attributions.

Keywords: Information Overload, Attribution Theory, Dark Side of IT, Continuance Behaviors

6.1 Introduction

The rapid innovation and development in the area of information systems (IS) and especially in mobile computing, leads to a ubiquitous presence of information and communications technology (ICT) in people's everyday life. Ubiquitous computing offers many opportunities for humans, such as the availability of information at any time and any location (Rutkowski et al. 2013). Nowadays, this kind of information availability is common for humans, and they claim this characteristic or other features for novel applications. Therefore, software providers develop more powerful applications with rich features. The dark side, however, is that this approach also creates more complex applications and information overload (Benlian 2015a; D'Arcy et al. 2014).

Information overload describes the cognitive conditions of a person when the existing amount of information exceeds the individual information processing capacity and leads to stress or frustration (Lu and Yang 2011; Xu 2016). Xu (2016) found that stress or frustration caused by complex websites, in turn, decrease user satisfaction and induce users to decrease their usage of the website. However, studies in consumer research building on attribution theory show that users' reactions depend on the attributed cause of product failure (Folkes 1984). Transferring those findings, in this paper, we argue that different attributions of blame for information overload could also cause different user reactions regarding IS use. In particular, we analyze the effects of internal (attribute to themselves) and external (attribute to the mobile application) attributions of blame for information overload on users' continuance intention. We further focus on the smartphone context because the small display size and the touch-based user interface are particularly prone to information overload perceptions.

In contrast to business application usage, private application usage is self-determined by users. So, private users can easily switch to another application that fulfills the same purpose in case they are not satisfied. Furthermore, the acquisition costs for a new customer can be five times higher than the costs for maintaining one (Bhattacharjee 2001). Therefore, for software providers, it is important to avoid switching of users to another system to ensure the continuance usage and profitability of their own systems. Consequently, new insights about factors that inhibit or promote the continuance usage of a mobile application can not only lead to more sales and revenues but also a strategic advantage for software providers. Thus, analyzing the impacts of information overload

and different attributions of blame on users' continuance intention is a crucial matter for software providers.

Prior research on information overload mainly focuses on its influences on decision quality or consumer and communication behaviors. First studies also show that information overload can cause adverse effects such as emotional consequences, which could also influence IS usage (Hsu and Liao 2014; Krishen et al. 2011). The impact of information overload on continuance intention, especially in the context of mobile applications, however, has so far rarely been examined. However, this is important because there is a difference between the way of using mobile applications and conventional software applications (Gong and Tarasewich 2004). For example, mobile applications differ from conventional desktop software in terms of the way how they are operated and how they are displayed (Ferreira et al. 2014).

In addition, while attribution theory rooted in psychology is increasingly being considered in other areas of research (e.g., finance Chen et al., 2016), we did not find any study answering the call of (Martinko et al. 2011) building on attribution theory to explain IS use behavior.

Therefore, the purpose of this paper is to address those gaps by answering the following research questions:

RQ 1) What is the impact of information overload on users' continuance intention to use a mobile application?

RQ 2) How do different attributions of IS failures (internal vs. external attribution) affect users' continuance intention?

To answer these questions, we conducted a scenario-based online experiment with 120 participants. The scenario-based approach allowed us to analyze the causal effect of information overload on users' continuance intention as well as different effects of various attributions of blame in an isolated manner. Hereby, we contribute to existing IS continuance research in three ways. First, we provide a possible operationalization of the construct information overload in scenario-based experiments. Second, we show that there is no direct effect, but the effect of information overload on continuance intention is fully mediated by satisfaction and perceived usefulness. Finally, third, we show that those effects vary by different attributions of blame for the information overload.

The next section provides an overview of the literature on IS continuance, information overload, and attributional theories. Afterward, we develop seven hypotheses, which we empirically tested in an online experiment. The third part of our paper describes the experimental method. Finally, we present and discuss the results of our study.

6.2 Theoretical Background

6.2.1 Information Systems Continuance

The information systems continuance model (ISCM) (Bhattacharjee 2001, p. 359) is one of the most prominent IS continuance models. The ISCM postulates that the continuance intention is primarily based on experiences gained from previous IS use as well as on expectations of a future advantage from the IT use. According to Bhattacharjee (2001, p. 359), IS continuance intention describes “users' intention to continue using of an IS”. The main antecedents of IS continuance intention are the constructs confirmation and satisfaction from the expectation confirmation theory integrated with construct perceived usefulness (Bhattacharjee (2001)). The relationships within the ISCM are based on solid theoretical grounds and have been validated in a number of follow-up studies (Deng et al. 2010; Limayem et al. 2007). As information overload might affect users' experiences with and future expectations from mobile applications use, we deem the ISCM as well suited for investigating the effects of information overload (a personal experience) on users' continuance intention in the mobile context. We further adapt the definitions of Bhattacharjee (2001, p. 359) to our context and define users' satisfaction with the mobile application as “users' affect with (feelings about) prior IS use” and perceived usefulness as “users' perceptions of the expected benefits of IS use” (Bhattacharjee 2001, p. 359).

6.2.2 Information Overload

In previous research, information overload is regarded as an amount of information that individuals cannot effectively capture or process (Lu and Yang 2011). For example, research disciplines like marketing, accounting, and consumer research have analyzed possible outcomes of information overload (Eppler and Mengis 2004; Jones et al. 2004), such as repercussions concerning decision quality or communication behavior of individuals. They show that too much information causes stress and feelings like overwhelming, which leads to suboptimal decisions. In the context of IS, Maier et al. (2015b) dissected the effects of technostress on IS discontinuance intention and

operationalized technostress due to different stressors. One of these stress emerging factors (stressor) was information overload. We could not identify any other IS study on the role of information overload for users' continuance intention.

To derive a definition of information overload, we borrow a construct from the area of cognitive psychology, namely information load, which refers to a given amount of information in a fixed time period (Krishen et al. 2011). According to this, we define information load as the amount of information presented by an information system during a period. The existing definitions address a certain amount of information, which exceeds the individual information processing capacity. For our purpose, we build on those definitions and describe information overload occurs when the present information load of individuals exceeds their information processing capacity. Resulting negative effects, such as a decreasing perceived performance, are outcomes of information overload.

Information overload is a strongly subjective problem depending heavily on certain situations (Krishen et al. 2011; Rutkowski et al. 2013), regardless of gender, culture, or education (Ahuja and Thatcher 2005; Hsu and Liao 2014; Jones et al. 2004). The increasing number of publications indicates that information overload is more and more important in the context of IS research (e.g., Lee et al. 2016; Zhou and Guo 2017). Due to the ability of information systems to produce and spread information more frequently than ever (e.g., via e-mail), information overload comes more and more into the focus (Barley et al. 2011). Furthermore, nowadays, we live in a fast-moving society, and information overload is more salient under conditions of time pressure (Mullins and Sabherwal 2014). Krasnova et al. state that the findings of the negative effects of the huge information consumption are alarming and they claim for further investigations of the underlying logic dynamics (Krasnova et al. 2010; Krasnova et al. 2013).

6.2.3 Attribution Theory

Psychology's attribution theory deals with individuals' explanations for the causes of their successes or failures (Heider 1958). Accordingly, humans act like naive scientists and try to explain behavior on the basis of incomplete information (Heider 1958). Different attributions of blame for a related issue do not influence the issue itself, but they influence the consequences resulting from it (Weiner 1985). Some research disciplines, like finance (Chen et al. 2016) or marketing (Camilleri 2017), have adopted

attribution theory to explain, for instance, how investors react to a different attribution of managers' negative guidance news. In the IS security research exists a related approach from Siponen and Vance (2010). They investigated in which way users' may use neutralization techniques to reduce perceived harm of their policy violations. Both the neutralization techniques, as well as the attribution theory, do not change the related issue, but they are different in the underlying mechanism.

In the case of the attribution theory, the assignment of the cause is differentiated between three dimensions: stability, controllability and locus (our focus). Stability refers to the extent to which the determined causal factors can be regarded as constant or variable. Controllability deals with the degree to which a person is presumed to be able to influence a result. The dimension locus deals with the perceived place of causality. Herby, it can be distinguished between internal (individual assign the location of causality in itself) and external places of causes (place of causality in the case of third parties or external influences). We make use of this distinction and define internal attributions of locus as assigning the cause of a related issue within oneself and external attributions of locus as assigning the cause of a related issue to the environment.

6.3 Research Model and Hypotheses

To investigate the relationship between information overload and IS continuance intention regarding mobile applications, we build on the ISCM model and extend it with information overload. We hypothesize relationships between information overload, perceived usefulness, satisfaction, and continuance intention. Furthermore, to analyze the role of attributions, we differentiate between two different cases: internal and external attributions of blame. We hypothesize direct and indirect relationships between information overload and users' continuance intention regarding mobile applications that are moderated by the attributional dimension locus.

In a group context, Paul und Nazareth (2010) showed a negative correlation between information overload and the perceived process satisfaction. At the individual level, Gao et al. (2012) analyzed that a higher decision quality leads to a higher satisfaction level and vice versa. Building on this, we argue in our context that a lower decision quality caused by information overload leads to lower user satisfaction with the mobile application. This is consistent with existing literature in research of technostress. Scholars examined a negative effect from technostress on users' satisfaction. However, it

should be noted that technostress consists of various stressors, one of which is information overload.

Extending these findings to mobile applications, it is also conceivable that information overload influences user satisfaction with the mobile application (not a normal or a mobile website). Due to the small display size, it is not possible to provide many information on the screen in a normal font size. Ordinary, mobile applications use symbols or short cuts to provide more information in a small space. In this case, a back transformation of the short cut into the content by the user is necessary, which causes an additional influence on information overload. Furthermore, if the user receives a huge amount of information and wants to compare this within the mobile application, because of the small font size, the short cuts as well as the small space on the display it is a hard task. In addition, mobile applications are less powerful than normal desktop applications. Thus, usually, it is not possible to switch the position of several information entries or to highlight multiple information entries within the mobile application. These actions are necessary to reduce the cognitive effort, but not possible. Due to the touch user interface, it is often difficult or impossible to consolidate information in an additional document or application. Moreover, in general, a huge amount of information is split on several sites in a mobile application. Satisfaction is influenced by the affection with prior IS use. Individuals are used to the handling of information by ordinary desktop applications or websites. In comparison, users tend to be less satisfied with the mobile application, when they recognize that the effort to fulfill the task is bigger or needs more time. Therefore, we hypothesize:

H1: A higher level of information overload has a negative effect on users' satisfaction with the mobile application.

Changes in individuals' behavior are another reported negative outcome of information overload (Ahuja and Thatcher 2005). Following Ahuja and Thatcher (2005), changes in individuals' behavior can lead to lower satisfaction and lower performance. The definition of perceived usefulness refers to individuals' perception of three parts: first, the effectiveness of the work, second productivity, and third the relevance of the system for the job (Yang and Yoo 2004). Decreasing perceived productivity can be equated with a lower perceived performance. Furthermore, in information overload situations, scholars analyzed a declining perceived efficiency, which represents one part of

perceived usefulness (Gao et al. 2012; Yang and Yoo 2004). Hence, we presume that information overload has a negative effect on perceived usefulness.

Usually, mobile applications reduce the font size, use symbols to display the content information, split information on different sites, or present a huge amount of results in “a never ending scrolling list”. For example, if the user wants to compare different information, e.g., several search results to choose a suitable restaurant, he or she must read small font sizes, switch between different sites and must retransfer or search different symbols. Compared to the search on a large screen, all of this leads to a high cognitive effort. Furthermore, the touch-choice of one button is very hard if the presented information is very small. Due to the high cognitive effort, the user does not perceive the application as useful and cannot, therefore, expect any great benefit from its use. Therefore, we hypothesize:

H2: A higher level of information overload has a negative effect on users' perceived usefulness of a mobile application.

Next to these two postulated effects, we assume a direct negative effect between information overload and continuance intention. Weak signals for this effect are provided by Maier et al. (2015a) and Hsu and Liao (2014). Maier et al. (2015a) considered discontinuance intention instead of continuance intention. According to Turel (2015), discontinuance and continuance are two different intentions, which correlate in some cases. Following Maier et al. (2015a) discontinuance intention represents the intention of the final termination of the use of the information system (e.g., deleting the social network account). They analyzed a positive effect between technostress and discontinuance intention. The postulated effects due to Maier et al. (2015a; 2015b) would be equivalent to a negative effect between technostress and continuance intention. Moreover, the hypothesized direct effect between information overload and continuance intention is strengthened by the insights of Hsu and Liao (2014). They have shown that the use of microblogs decreases significantly when users experience information overload.

This effect is also conceivable in the use of mobile applications. If users receive a huge amount of information, they feel overwhelmed by this amount (e.g., Huang 2003). In comparison to a large display, a huge amount of information on a small display appeals more overwhelming. This strong overwhelming feeling can lead to a lower continuance

intention because, in this very overwhelming situation, individuals do not perceive usefulness or satisfaction. Thus, information overload will affect continuance intention also in a direct way, which leads to our third hypothesis:

H3: A higher level of information overload has a negative effect on user's continuance intention of a mobile application.

We apply the ISCM model to our mobile context. Bhattacharjee's (2001) postulated relationships are re-proved in several studies. The following hypotheses are in line with previous research. Therefore, we relinquish on a long derivation, and hypothesize:

H4: A higher level of users' satisfaction with the mobile application causes a higher continuance intention of a mobile application.

H5: A higher user's perceived usefulness of a mobile application causes a higher continuance intention of a mobile application.

H6: A higher users' perceived usefulness of a mobile application causes a higher level of users' satisfaction with the mobile application.

Finally, we hypothesize a moderating effect of attributions of blame for the overall effect of information overload on users' continuance intention in the context of mobile applications. Oliver (1980) shows that individuals' satisfaction increases when internal causes can be attributed to an event. By contrast, external attributed causes, such as product defects, can decrease product satisfaction (Folkes 1984). Thus, different appraisals of cause attribution can trigger a subconscious mental process, which results in more (or less) favorable valuations of the respective cause. Moreover, consumers react angrily to a company when an external attributed cause is additionally attributed as controllable and thus, avoidable by the manufacturer (Folkes 1984). Such angry reactions are also often mentioned as a consequence of technostress (Ayyagari et al. 2011). Transferred to the context of mobile applications, this means that the causal attribution of blame regarding the dimension locus (internal vs. external attribution of blame for information overload) can affect the effect strength of information overload. We expect that an external attribution of blame for information overload will lead to a lower continuance intention. If users are overwhelmed by too much information, they will attribute the information overload to either an internal or an external cause. In case of an internal cause, such as the wrong usage, users perceive that information overload is their own responsibility, and they have control over the extent of future information

overload. Thus, the effect on users' intention to continue using the system will be smaller than compared to an external cause, such as a system error. An internally attributed blame might even override the negative effect of information overload on continuance intention resulting in a higher continuance intention. Further, we assume that the effects of information overload on satisfaction as well as on perceived usefulness are also moderated by the attribution of blame and thus influence users' continuance intention. As such, we predict that a different attribution of blame (i.e., particularly an internal attribution of blame) will attenuate or even wipe out the overall effect of information overload on users' continuance intention in the context of mobile applications, leading us to the following hypothesis:

H7: The attribution of the blame for information overload moderates the direct and mediated effects of information overload on continuance intention in such a way that the external (internal) attribution of the blame causes an increase (a decrease) in the total effect strengths.

Figure 26 summarizes our hypotheses and presents our research model. We do not display our seventh hypothesis, because it considers group differences in the whole research model.

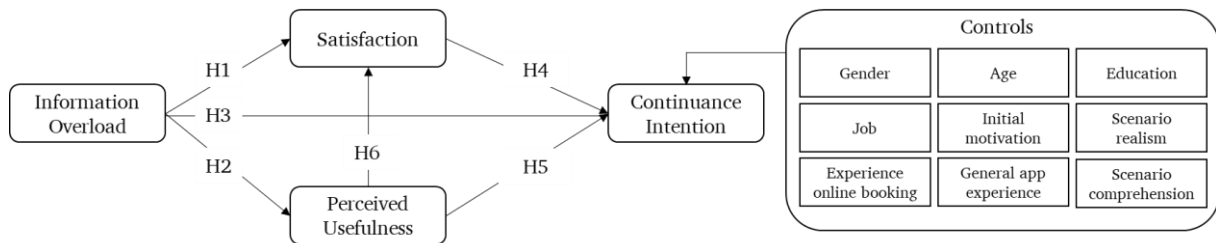


Figure 26: Research model, including hypotheses and control variables.

6.4 Methods

In order to test the research model (Figure 26), we conducted a scenario-based experimental study. This section first points out the experimental design. Then, we present items' operationalization as well as manipulation checks and control variables.

6.4.1 Experimental Design and Manipulations

To test our model, we used a scenario-based full-factorial study (experimental vignette methodology) with four carefully constructed vignettes (cf. Appendix 1). To avoid test fatigue, we used a between design in which each participant only presented one scenario.

Scenario-based experiments are well suited for contextually related problems, such as information overload or unethical behavior (Siponen and Vance 2010). The four textual scenarios (vignettes) have been designed in such a way that all have a high experimental realism, a high internal validity and a high variance of information overload as well as attribution of blame (Aguinis and Bradley 2014). In doing so, we have considered the best practices for vignette studies recommended by Aguinis and Bradley (2014) as well as the recommendations by Atzmüller and Steiner (2010). To increase the scenario realism, we used fashionable pictures. Moreover, we followed the methodical approach of Vance et al. (2013) and Lowry and Moody (2015) and evaluated the scenario realism by experienced researchers before conducting the pretest.

Our first vignette contains the initial description of the fictitious person, the task as well as the technological conditions, which are influencing factors of information overload (Eppler and Mengis 2004). Our second vignette contains the manipulations. The manipulation of the independent variable information overload took place by a different number of the presented search results. We presented one group a search result with 12 unsorted entries. The other group received 216 unsorted entries. The manipulation of attributions of blame for the information overload took place by a hint that the fictive person thinks about the search site and why the person did not narrow down the search anymore. In this case, the person attributes the blame to himself. The last pages were used to capture the dependent, independent, and control variables. We also carried out manipulation checks (e.g., the correct amount of the displayed results) as well as an attention trap on these pages. To reduce the common method bias, we followed Podsakoff et al.'s (2003) three recommendations and 1) noted that participants should answer honestly, and there are no right and wrong answers, 2) guaranteed anonymity for the evaluation and 3) used different answer formats.

6.4.2 Measured Variables and Measurement Validation

We used established measurement instruments to operationalize the constructs: initial motivation from Fleischmann et al. (2016); satisfaction and continuance intention from Bhattacharjee (2001); perceived usefulness from Venkatesh et al. (2012) (we used the performance expectancy items which are substitutable with the perceived usefulness items (Bhattacharjee and Lin 2015); information overload from Sasaki et al. (2015); attributions of the locus (internal vs. external) from Brockner et al. (2007). The items

for the measurement of the scenario realism were self-developed. In the literature are some hints that comparable items were used in other studies, but they have not been published (Vance et al. 2013).

6.4.3 Procedures

Before conducting our main study, we pretested the conceptualization with 26 participants. The participants reported only small typing mistakes, which we corrected. The pretest results showed sufficient indicator reliability as well as sufficient construct and discriminant validity. Therefore, no further adjustments were necessary after the pretest. The study was conducted within 21 days. The participants were acquired in social media, via mail campaigns, and the distribution of flyers at railway stations and at various universities. We chose these heterogeneous acquisitions activities in order to achieve the greatest possible diversification of the participant with regard to regions, interests, professional activity, and age to achieve a high external validity. We got 432 page impressions on our study website, and 182 participants completed our study.

6.5 Analysis and Results

We used SPSS version 24 and Smart PLS version 3.2.7 for the evaluation of the results (Ringle et al. 2015). We cleaned up the data, converted the reverse coded variables, and produce descriptive statistics with SPSS. Following Ahuja and Thatcher (2005), we chose for our analysis the variance-based PLS approach because it is suitable for non-normal distributed samples and small sample sizes (Benlian 2015b). For the investigation of our seventh hypothesis, it was necessary to split our sample. Therefore, altogether, we calculated three different models. Model 1 served for the investigation of hypotheses one to six and contained the whole sample. Unless otherwise stated, the following evaluations refer to this model. To analyze H7, we compared model 2 containing those participants who attributed the blame to the system with model 3 containing those participants who attributed the blame to themselves.

6.5.1 Sample Description, Controls, and Manipulation Checks

We have excluded 62 participants due to faulty manipulation checks, or they had carried out the survey too quickly (Koch and Benlian 2015). With 120 valid records, our sample fulfills this requirement for exploratory factor analysis (MacKenzie et al. 2011). The average age of our participants was 29.50 years, and 48 % were female. 69 % have a university degree as the highest education level, 19 % an A level, and 12 % reported

other graduations. The distribution of the current job-activities shows that 45 % of all participants were students, 44 % were employed or self-employed, and 11 % reported another activity. The participants' experience in dealing with mobile applications could be classified as high. 83 % of the participants reported that they use mobile applications every day. Comparable high experiences exist regarding the dealing with online travel services (4.98 on a 7 point Likert scale). The initial motivation was assessed by the participants in an average of 5.48 on 7 point Likert scale, which can be regarded as highly motivated. Furthermore, the understanding of the vignettes (6.37) and the realism of the scenario (5.80) was also assessed as very high (all items measured by a 7 point Likert scale). We also calculated these values for models 2 and 3. Both showed comparable results.

6.5.2 Measurement Assessment

We assessed the measurement model based on convergence and discriminant validity. Three criteria should be examined to determine the convergence validity (Xu et al. 2012): First, the indicator reliability of all factor loadings should be above 0.65 (Falk and Miller 1992), second the average variance extracted (AVE) of the constructs should be above 0.50 (MacKenzie et al. 2011) and third the composite reliability should be above 0.80 (Benlian et al. 2011). Furthermore, Cronbach's alpha measure is regularly reported in studies which are using structural equation modeling. The applied threshold is above 0.70. Table 8 shows that all criteria are fulfilled, and convergence validity is met.

Construct	Cronbach's alpha	CR	AVE	Correlation of the constructs			
				CI	IO	PU	SAT
CI	0.931	0.956	0.880	0.938			
IO	0.814	0.877	0.642	-0.290	0.801		
PU	0.869	0.911	0.719	0.743	-0.382	0.848	
SAT	0.862	0.906	0.708	0.604	-0.394	0.642	0.841

Bold-printed = Squared root of the AVE
IO = Information Overload; SAT = Satisfaction; PU = Perceived Usefulness; CI = Continuance Intention;
CR = Composite Reliability; AVE = Average Variance Extracted

Table 8: Cronbach's alpha, composite reliability, AVE and construct correlations.

	CI	IO	PU	SAT
CI 1	0.941	-0.287	0.704	0.586
CI 2	0.961	-0.305	0.727	0.578
CI 3	0.911	-0.222	0.660	0.533
IO 1	-0.269	0.825	-0.357	-0.346
IO 2	-0.216	0.794	-0.304	-0.282
IO 3	-0.241	0.840	-0.316	-0.344
IO 4	-0.195	0.741	-0.232	-0.282
PU 1	0.734	-0.327	0.862	0.607
PU 2	0.599	-0.337	0.866	0.524
PU 3	0.639	-0.374	0.876	0.501
PU 4	0.528	-0.252	0.784	0.541
SAT 1	0.489	-0.351	0.581	0.825
SAT 2	0.522	-0.325	0.502	0.859
SAT 3	0.523	-0.382	0.555	0.871
SAT 4	0.498	-0.262	0.521	0.809

All factor loadings are highly significant at a level of $p = 0.000$.
IO = information overload; SAT = Satisfaction; PU = Perceived Usefulness; CI = Continuance Intention.

Table 9: Factor analysis - item (highlighted) and cross-loadings.

For discriminant validity, two criteria must be fulfilled (Chin 2010): first, the variance of the construct should be greater than the shared variance between this construct and all other constructs in the model. Second, the Fornell-Larcker criterion must be met. As shown in Table 9, all item loadings within the corresponding construct are larger than the corresponding cross-loadings. Moreover, the Fornell-Larcker criterion was fulfilled, and thus discriminant validity is met. We also investigated the convergence and discriminant validities for models 2 and 3 and found all criteria met. In addition, to check for multicollinearity, we determined the variance inflation factor in each model. All values were below 4.2 and, thus, significantly below the threshold of 10 (Field 2018).

6.5.3 Results of the Structural Equation Modeling

The predictive validity is evaluated by the variance explained in the dependent variables (R^2). To test the significances of our hypotheses, we use a bootstrapping with 5000 resamples (Krasnova et al. 2013). Figure 27 summarizes the effects of model 1 with

n=120 participants. With the exception of hypothesis 3, all hypotheses could be confirmed.

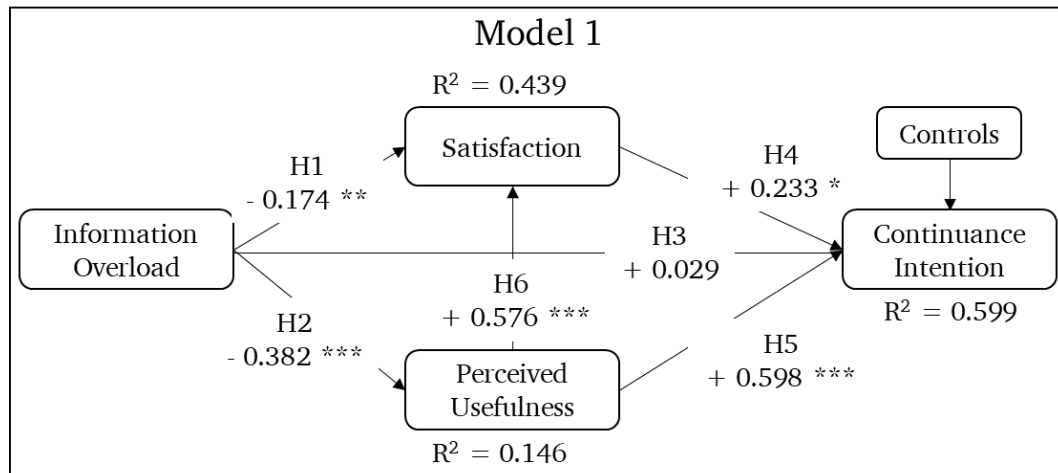


Figure 27: Results of the structural equation model 1.

Figure 28 contains the evaluation of model 2 (n=47) and model 3 (n=73) to test H7. The relationship between satisfaction and continuance intention showed a significant change in the effect. The path coefficients of the relations of H2, H4, and H5 strongly differ between both models. If the blame is attributed to oneself, the path coefficient is by 0.040 lower. In addition, the p-value of the relation of H4 in model 2 was 0.026, and it changes in model 3 to 0.144, which is clearly insignificant. Moreover, the descriptive statistics in Table 10 exhibits that the continuance intention of users, which attribute the blame to the system (model 2) is lower than the continuance intention of users, which attributes the blame to themselves (model 3), as hypothesized by us. Finally, we re-tested our models, including control variables, and found no significant change in the effects.¹

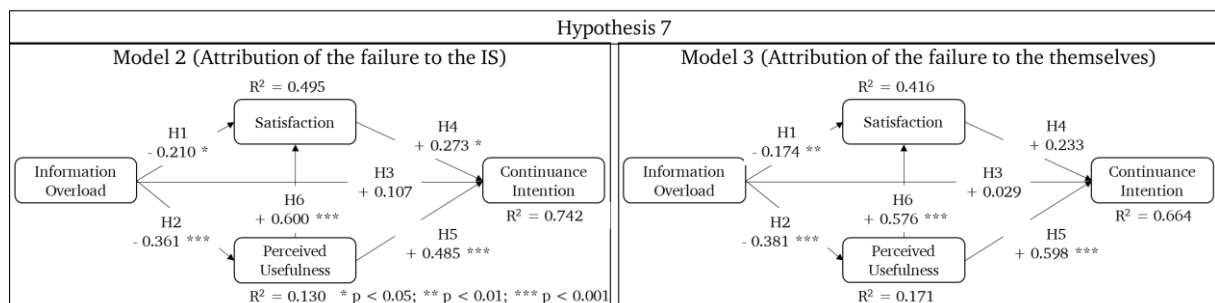


Figure 28: Results of the structural equation models 2 and 3.

¹ Due to space limitations not included, results can be requested by the authors.

Construct	Model 1					Model 2					Model 3				
	N	Min	Max	Mean	σ	N	Min	Max	Mean	σ	N	Min	Max	Mean	σ
CI	120	1.00	7.00	4.061	1.613	47	1.00	7.00	3.660	1.724	73	1.00	7.00	4.320	1.493
SAT	120	1.00	6.00	3.692	1.015	47	1.00	6.00	3.457	1.112	73	1.00	6.00	3.842	0.925
PU	120	1.00	7.00	4.777	1.417	47	1.00	7.00	4.596	1.427	73	1.50	7.00	4.894	1.407
IO	120	1.25	7.00	5.385	1.365	47	1.25	7.00	5.245	1.489	73	1.50	7.00	5.476	1.281
CI = Continuance Intention; SAT = Satisfaction; PU = Perceived Usefulness; IO = information overload; σ = std. deviation															

Table 10: Descriptive statistics.

6.6 Discussion

The objective of the study was to identify how information overload influences users' continuance intention of mobile applications and the impact of different attributions of blame for the information overload in this context. We tested three hypotheses postulating direct and mediated effects from information overload on continuance intention to derive first insights for IS research and providers of mobile applications. Furthermore, our results regarding different attributions of blame for the information overload contribute important insights for existing research. We demonstrate that different effects exist, depending on internal and external attributions of blame. This insight can lead to the fact that studies dealing with adverse IS effects require a new consideration because, in this case, users' can also use different attributions that influence their reactions. In details:

Our first hypothesis postulates a negative effect of information overload on satisfaction. We show that information overload has a strong negative influence on users' satisfaction with the application. This finding can be placed in a coherent relationship with the findings of Maier et al. (2015a), who analyze the contributions of technostress in the context of social network usage. Maier et al. (2015a) use the construct disclosure, which only covers too much information disclosed in social networks by oneself and one's virtual friends. We regard the whole amount of the presented information inside a mobile application and not only one special kind of information. Therefore, our view includes different types of information as well as different causes of information overload. Thus, our point of view is a more general one. Furthermore, a large part of technostress-studies conceptualizes technostress as chronic and comprehensive stress, which results from material properties of ICTs such as an unbroken ICT connectivity (Ayyagari et al. 2011; Reinke et al. 2016). We analyzed one stressor (information overload), which is different

from the material properties of ICT-based communication events and examines the impact of information overload on satisfaction, perceived usefulness, and continuance intention. In addition, Maier et al. (2015a) argue that discontinuance intention and continuance intention are different behavior patterns, thus a differentiated analysis is necessary.

We also find support for H2 by showing a strong negative effect from information overload on perceived usefulness. Tarafdar et al. (2007) analyze the relationship between role overload and productivity and find that role overload affects productivity in a negative way. Neither the productivity as well the role overload is directly comparable with our constructs. For example, role overload deals with the role function in the job. Therefore, this finding can only be viewed as a weak similarity. Our result shows that information overload affects perceived usefulness in a strong way. Perceived usefulness is a famous construct in IS research. It is conceivable that this insight in other contexts or other theories also serves for a new understanding or another consideration.

Moreover, it is well researched that satisfaction, and perceived usefulness are one of the main contributors for continuance intention (Bhattacharjee 2001). In addition, we can show a negative effect from information overload on satisfaction as well as a strong negative effect of information overload on perceived usefulness. Hence, we also demonstrate that information overload strongly diminishes the continuance intention of mobile applications.

We could not find support for H3. We analyzed that the effects of information overload are fully mediated by the constructs perceived usefulness and satisfaction. Although we assumed another effect, this finding agrees with the insights of Bhattacharjee's (2001) ISCM. In addition, H4-H6 serves for the replication of the relationships of the ISCM. We show that these relationships also exist in the mobile app context.

Our second objective was to analyze the effect of different attributions of blame for the information overload on users' continuance intention. Our results provide first insights that this topic area should also be investigated more closely in IS research. We find that users' continuance intention differs depending on whether the user attributes the blame for the information overload to himself or to the application. If users' attributes the blame to themselves, they have significantly higher continuance intention instead of an attribution to the application. In addition, we were able to show that different

attributions cause a change in the significance level of the effect between satisfaction and users' continuance intention. A different continuance intention, caused by different attribution of the blame of an adverse effect (information overload), suggests that this influence also exists in other contexts. It is conceivable that the adoption, as well as the continuance intention of IS, can be massively influenced by attributions. For example, if the system detects an incomplete or poor input, then input suggestions can use to give a hint for the necessary input parameters and demonstrate that the user was responsible for the mistake. Therefore, studies dealing with the adverse effects of IS could require a new consideration.

6.6.1 Implications for Research and Practice

We contribute to new research in the field of IS continuance. We show that information overload has a negative indirect impact on users' continuance intention to use a mobile application. We analyzed a direct effect of information overload on satisfaction as well as on perceived usefulness. The existing results in the area of technostress by Maier et al. (2015a) or Tarafdar et al. (2007) conceptualize technostress as chronic and comprehensive stress, which results from material properties of ICTs (Reinke et al. 2016). In our case, we regard one single stressor and show that this stressor influences users' continuance intention in a negative way. Thus, we expanded the existing research of Maier et al. (2015a). Furthermore, we also show for the first time that the negative effect is completely mediated by the constructs satisfaction as well as perceived usefulness. Therefore, our findings contribute new insights into the existing research in the area of information overload as well as users' continuance intention to use a mobile application. It is conceivable, that these findings can adapt to other situations or applications.

We also contribute by investigating causal attributions and information overload. Both causal attributions, as well as information overload, are strongly subjective and heavy situational depending. Therefore, our chosen scenario-based approach is suitable for this kind of problem. Due to carefully constructed textual scenarios, we could meticulous and precisely describe details of a fictive person and a specific task. In addition, we were able to use a symbolic screenshot to increase the scenario reality. Following Eppler and Mengis (2004), these components influence the information load and can lead to information overload. Furthermore, we could manipulate isolated factors to control the

different levels of information load and forms of the causal attribution. Our results constitute that the used approach is appropriate for research in the area of information overload, causal attributions as well as IS continuance. However, to validate the suitability, further studies should be done.

Further, we have demonstrated that attributions of blame for information overload affect the continuance intention of an IS. Based on our knowledge, this is the first study to consider causal attributions in the context of IS. This new insight points out a new and large research area in the IS research. It indicates that the existing research on IS Continuance, especially in the case of adverse effects such as the effects of stress on the users' continuance intention, should be reinterpreted and extended. Furthermore, the attribution theories should be examined in more detail, and their effects on existing constructs should be investigated. In addition, existing IS theories should be investigated, taking into account attribution theories.

From a practitioner's perspective, our study also provides important implications. The spread of smartphones and tablets has continuously increased in recent years (Tenzer 2016), and for providers of mobile applications, the continuance use of their software is an important strategic factor for their economic success (Bhattacharjee 2001). Due to the physical properties of smartphones and tablets, such as a smaller display, they can cause a higher information load and, therefore, rather, information overload. We demonstrate that information overload reduces users' continuance intention. Especially in the development of mobile applications, it should be emphasized that users do not experience too high information load during application usage. In addition, we demonstrated that the negative effect of information overload is fully mediated by satisfaction and perceived usefulness. So, these insights enable software providers to develop more specific countermeasures to increase satisfaction as well as perceived usefulness. Moreover, if users' attribute the blame for information overload to themselves, they have a higher continuance intention. This indicates that practitioners should use hints for the user, that they attribute failure more to themselves.

6.6.2 Limitations, Future Research

The results of the study are subject to certain limitations. We used a scenario-based research approach, in which the manipulations were carried out by means of a textual description. Although the used method was appropriate for the context of our study and

a large part of the postulated hypotheses could be demonstrated empirically, some limitations of the scenario method should be explained in more detail. In our study, we asked the participants to move into the role of a fictitious person and answer some questions from the person's point of view. This is certainly advantageous to evoke perceptions regarding factors of the dark side of IT usage (Lowry et al. 2013; Vance et al. 2013). However, there may still be a difference between the real behavior of the participants and the given behavior in the role of the fictional person. Nevertheless, the control questions showed that the participants considered the scenario to be very realistic and that they placed themselves well in the role of the fictitious person. In addition, we did not control how well our participants liked to spend their holidays. The high scenario realism indicates that the chosen story was highly realistic, and therefore we assume that the participants were able to identify themselves with the story. Therefore, we deem our scenarios and manipulations as realistic but recommend to validate the results in the future.

A second limitation is the distribution of the sample. Despite the heterogeneous acquisitions, the sample included many participants with a very high education level (academic degree and upper). Although information overload can occur in any human being regardless of his or her education level (Grisé and Gallupe 1999), we suggest a follow-up study with a more balanced sample.

6.7 Appendix

Philipp is 29 years old and works in a company. Due to the high order situation, Philipp is currently making many overtime work and arrives home late at night. Two years ago Philipp started to ski. To escape everyday life, he plans a skiing holiday with his two friends Christian and Max.

Philipp was only two times skiing. Therefore, he don't knows ski resorts and is only able to ride on easy and flat slopes (the blue). To relax after the skiing day, Philipp would like to go to the sauna. Hence, a hotel with a wellness area is very important for him.

The holiday should start in 9 days and Philipp is responsible for the booking of the resort as well as the hotel. He promised Christian and Max to book the hotel this evening at the latest. Because of the many orders at his workplace, Philipp arrives at home at 22:30 h. It is very late and Philipp wants to sleep fast, so he decides to invest a maximum of 30 minutes into the search and booking of a suitable resort and hotel.

So far, Philipp has no idea which ski resorts are suitable for him. A work colleague Philipp told him that the App Move to Snow is very suitable for finding and booking ski tours. Move to Snow offers information about the slopes in the ski resorts as well as information about available hotels in the region. To narrow down the search, Philipp enters his criteria after starting the app and clicks "Search" (see figure)....

Table 11: Vignette 1 of our study – initial description.

The app presents Philipp a table with his search results. The table contains 216 (Groups 1 & 2 / Groups 3 & 4 – 12 entries) unsorted entries (see figure). It is not possible to sort the entries. Each row of the table contains the name of the ski resort, the number of blue (light) slopes, the number of free hotels inside of the resort as well as a subjective review from other users. To get an overview, Philipp scrolls through the list of his search results. He studies the information very closely and built a mental a sequence of the interesting ski resorts in his head.

After a while, he realizes that he has lose track of the situation. For him, all the names of the ski resorts sounds equal. He cannot remember which resort he likes and which ones not. He cannot built a mental a sequence of the 216 unsorted results. Furthermore, his planned 30 minutes have already expired, so Philipp is booking the next ski area. (Groups 1 & 2)

Philipp finds it hard built a mental a sequence of the 12 ski resorts in his head. Finally, however, Philipp has finished the sequence in his head and decides to book one ski resort. (Groups 3&4)

Philipp remembers the input mask of Move to Snow and thinks, "Why didn't I narrow down my search and choose Austria as my country? (Groups 1 & 4)

Table 12: Vignette 2 of our study – used manipulations.

7 Effects of Users' Resistance to Change on Their Post-adoption Behavior

Title: The Role of Resistance to Change in Software Updates' Impact on Information Systems Continuance

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Abstract

Although software updates are pervasively used by providers to enhance their software's functionalities over time, our understanding of the influence of such changes in the IT artifact on users' post-adoption beliefs, attitudes, and behavioral intentions is still limited. Moreover, potential divergent reactions to software updates emanating from users' individual differences have received little research attention so far. Drawing on the IS continuance model and theory of resistance to change, we investigate whether and how feature updates differentially affect the continuance intentions of users that are more vs. less resistant to change. In a vignette-based online experiment with 149 participants, we find a positive effect of feature updates on the continuance intentions of less change-resistant users, although the effect disappears for more change-resistant users. A moderated mediation analysis reveals positive disconfirmation as a mediating mechanism that is contingent on users' resistance to change. Implications for research and practice, as well as directions for future research, are discussed.

Keywords: Feature updates, Resistance to change, Individual differences, Continuance intention.

7.1 Introduction

To reduce time-to-market and keep pace with changing requirements, software providers increasingly release a lean version of their product instead of shipping a feature-complete product right from the start. In this way, software providers subsequently enhance the product through updates, while it is already being used. For example, the operating system Windows 10 received over 100 significant updates since its release in July 2015, and the popular social network Facebook received over 15 major feature updates (e.g., extended privacy controls, live video, 360° images) in the last years. A majority of smartphone platforms, modern desktop systems, and websites deploy such agile and malleable application systems that update their feature set on a regular basis (Hong et al. 2011; Schmitz et al. 2016).

In all these cases, additional functionality is delivered to users after the first release through (usually free) 'feature updates' that integrate into and change the base software once executed and thus cannot be considered a standalone but a complementary program (Dunn 2004). In the software engineering literature (e.g., Sommerville 2010), such a feature update falls within the strategic considerations regarding when to deliver functionality to the user (Svahnberg et al. 2010). We also must consider that modern software applications have manifested in nearly every aspect of society, which fosters users to accept using them even if they heretofore perhaps circumvented it. Because updates change the software during use, they may influence users' post-adoption beliefs and attitudes and thus even affect their intentions to continue using the software (Fleischmann et al. 2016). Thus, for software providers, to improve the design of their software, it has become very important to understand how different types of customers perceive such a feature update strategy instead of a feature-complete first release.

Post-adoption research that explores the user's perspective often tends to conceptualize information systems (IS) as a static black box rather than as a modular and dynamically evolving composition of specific features that may be changed after the software's first release (Bhattacharjee and Barfar 2011). Moreover, several IS scholars criticize the negligence of the IT artifact's role in IS research and therefore call for further research (Benbasat and Zmud 2003; Hevner et al. 2004; Orlikowski and Iacono 2001). They specifically emphasize the need for better understanding of the changes in beliefs, attitudes, and behavioral intentions emanating from the IT artifact itself, rather than

from other IT-unrelated environmental stimuli. Several scholars also call for better integration of individual differences into IS research to increase our understanding of potential interactions with belief updates and behavioral intentions (Devaraj et al. 2008; Maier 2012; McElroy et al. 2007). Especially, Maier (2012) identifies resistance to change (RTC) as a personality trait that might be of particular importance in this context. It reflects an individual's disposition to deal with changes, which is fundamental when considering modifications of software in use through feature updates.

However, research on software users' post-adoption beliefs and attitudes regarding software updates and individual differences has so far been very limited. In one of the few examples, Hong et al. (2011) explore users' acceptance of IS that frequently change through the addition of new functionality. Moreover, while Benlian (2015a) examines IT feature repertoires and their impact on individual task performance, he does not consider changes in these repertoires through updates. Fleischmann et al. (2016) are among the first to explore the effect of feature updates in a controlled laboratory experiment from a user perspective, however neglecting the fact that users can differ in the way they receive and assess changes. Although conventional wisdom and qualitative studies (Lapointe and Rivard 2005) would suggest that less change-resistant users may be more open to 'agile software', while more change-resistant users may rather be more reluctant, this crucial personality trait has neither been studied in the context of feature updates nor in the context of users' continuance intentions (CI). Against this backdrop, we seek to answer the following research question:

RQ) How and why do feature updates influence users' continuance intentions, differentiated by their dispositions to resist change?

Integrating IS continuance with resistance to change literature, we conducted a scenario-based online-experiment with 149 participants and found that resistance to change significantly shapes how software updates impact users' CI. In this way, we contribute to post-adoption research in three important ways. First, this study contributes to knowledge of personality traits in IS (Maier et al. 2019; Pflügner et al. 2019; Thatcher et al. 2018) by showing that reactions to feature updates are different between users with weak versus strong dispositions to resist change. These diverging findings for different types of users emphasize the importance of joint consideration of a changing IT artifact and individuals' differences when investigating their CI (Burton-Jones and Straub

2006; Hong et al. 2015). Second, this work complements previous knowledge on the mechanism behind different responses to updates (Fleischmann et al. 2016) by investigating the role of disconfirmation with previous expectations as a mediator, while simultaneously considering RTC as moderator for the effect of feature updates on users' CI. Third and lastly, our study extends the body of knowledge in IS post-adoption research (Kim and Son 2009; Li and Liu 2014) by showing how a malleable IS might influence users' attitudes and behaviors during use.

7.2 Theoretical Foundations

7.2.1 Feature Updates

We define software updates as self-contained modules of software that are provided to the user for free in order to modify or extend the software after it has been rolled out and is already in use. Software updates integrate into or change the base software once executed and cannot be considered as standalone programs (Dunn 2004). The practice of enhancing software through updates is applied to many different types of software such as office applications, firmware, computer games, operating systems, and on many different platforms such as desktop computers or mobile devices. Clearly, software updates are also a major topic in software engineering literature (Sommerville 2010), such as software release planning, software maintenance, and evolution, and software product lines (Weyns et al. 2011), although varying terminology is used (e.g., update, upgrade, patch, bug fix, or hotfix). Svahnberg et al. (2010) outline software release planning in this context as the selection of the optimal feature set for release within given constraints. This implies that the delivery of features through updates after the first release of a software is part of the strategic design of software regarding which functionality should be delivered to the user at which release.

Software evolution and maintenance literature address the later stages in the software lifecycle, where updates are utilized to adjust the software to changing requirements or repair flaws in the software, while it is already in use (Shirabad et al. 2001). However, in contrast to this rich stream of technical literature dealing with software updates from a provider perspective, research from a users' perspective considering post-adoption beliefs and attitudes regarding updates is very scarce. This consideration, however, is highly relevant, as users have different personality traits (Pflügner et al. 2019), which influences users' adoption behavior (Polites and Karahanna 2012). Thus, Hong et al.

(2011) and Benlian (2015a) have started to consider users' perspective in their studies. Hong et al. (2011) considered the change in the acceptance of agile IS through the addition of new functionality, and Benlian (2015a) examined IT feature repertoires and their impact on individual task performance over time. Nevertheless, these studies did not consider changes in features through updates over time, while the software is already in use. In an organizational context, Laumer et al. (2016) investigated the extent to which resistance to IT-induced change is influenced by the tendency of individual employees to resist change. However, in an organizational context, the use of a specific IS system is mandatory so that the results cannot be transferred to voluntary use. Among the first to study the effects of feature updates from a user perspective are Fleischmann et al. (2016) who explore users' responses to updates while using a software for task completion. However, although the study examined how feature updates affect users' CI, it implicitly assumed that all individuals are created equal and react similarly to feature updates. As such, individual differences in how feature updates are received by users were not considered, but according to Pflügner et al. (2019), this should be done in a differentiated manner.

In the following, we will distinguish feature updates and non-feature updates as two different types of software updates. Feature updates may affect the core functionality of software with respect to the software's main purpose. Functionality thereby refers to distinct, discernible features that are deliberately employed by the user in accomplishing the task or goal for which he or she uses the software. Non-feature updates, in contrast, do not change the core functionality of the software but are technical changes that repair flaws or improve basic properties of the software (e.g., higher performance, fixes of security breaches) and are typically not even visible to the user (Popović et al. 2001). Referring back to feature updates, they are most often recognized by users as they change the core functionality frequently used for task completion. Consequently, as the software's core functionality changes, feature updates may change the user's interaction with the software. This changed interaction has the potential to influence users' beliefs, attitudes, and behaviors regarding the updated software in the post-adoption stage of IS usage. Therefore, we also expect an impact on their CI.

7.2.2 Information Systems Continuance

The term information systems continuance refers to the “*sustained use of an IT by individual users over the long-term after their initial acceptance*” (Bhattacharjee and Barfar 2011, p. 2). To explore the intentions to continue or discontinue usage of an IS by its users, Bhattacharjee (2001) adopts expectation-confirmation theory (ECT) (Anderson and Sullivan 1993; Locke 1976; Oliver 1980; Oliver 1993). ECT explicitly focuses on users' psychological motivations that emerge after initial adoption. Following ECT, the IS continuance model includes concepts such as confirmation, perceived usefulness, and satisfaction as the main antecedents of CI (Bhattacharjee 2001). It suggests that users first develop expectations about the performance of the IS before usage. Users then assess the perceived performance of the IS with their initial expectations. The cognitive comparison between expectations and actual experience enables users to determine the extent to which their expectations are confirmed or disconfirmed. If users' perceived performance exceeds their initial expectations, they experience positive disconfirmation which increases their perceived usefulness and satisfaction. In contrast, if users' perceived performance falls short of the initial expectations, negative disconfirmation occurs, which decreases users' perceived usefulness and satisfaction (Bhattacharjee and Barfar 2011). Subsequently, users' perceived usefulness and satisfaction, in turn, influence their CI (Bhattacharjee 2001).

However, in its original form, the IS continuance model has a static perspective on the setting, failing to account for a change in user beliefs and attitudes over time. To resolve this shortcoming, Bhattacharjee and Premkumar (2004) introduce a more dynamic perspective by showing that beliefs and attitudes change from pre-usage to actual usage and during the ongoing usage of an IS (Kim and Malhotra 2005). While this dynamic perspective already provides valuable insights into the drivers of post-adoption behavior, it still neglects the IT artifact's changing and malleable nature. Evidence from practice shows, however, that information systems are constantly modified over time, for example, when vendors update and change their features or introduce new feature updates. Considering the fact that beliefs and attitudes change over time during the ongoing use as a result of users' experience with IT, it is reasonable to assume that a change in the IT artifact may also induce a change in users' beliefs and attitudes toward it. Kim and Son (2009), Ortiz de Guinea and Markus (2009) and Ortiz de Guinea and Webster (2013) have provided evidence that the IS itself can shape users' beliefs and

attitudes in later usage stages. Therefore, we expect that feature updates also have the potential to influence user's beliefs, attitudes, and even CI in the post-adoption stage.

7.2.3 Resistance to Change

Individuals' divergent tendencies to resist or avoid changes have already attracted much research attention in the past. Changes are, for example, alterations of how certain tasks are accomplished, readjustments of organizational goals or demands (Piderit 2000), implementations of information technology (Lapointe and Rivard 2005), or modifications of user interfaces (Nov and Ye 2008). Resistance can be reflected as an urge to maintain the status quo (Lewin 1952). Reasons for resistance are often found in situational aspects, for example, conflicts of interest (Coch and French 1948; Zander 1950). However, research increasingly shows that differences across individuals can also foster resistance (Judge et al. 1999; Oreg 2003). Such differences regarding individuals' disposition to cope with change can be conceptualized as a personality trait (McCrae and Costa 2003). Accordingly, in line with Oreg (2003), we define RTC as "*an individual's dispositional inclination to resist changes*". Individuals with a strong tendency will resist, avoid, or devalue changes more than people with a weak tendency (Oreg 2003). Oreg (2003) proposes a generalized concept to account for four main facets of resistance: *routine seeking* reflects the need of individuals for a stable and familiar environment. *Emotional reactions* reflect the lack of psychological resilience. *Short-term focus* reflects the myopia, the preference for short-term over long-term benefits. *Cognitive rigidity* reflects the consistency with and obedience to views and opinions over time. These four facets jointly reflect an individual's disposition to resist change (Polites and Karahanna 2012).

Personality traits and their impact on beliefs, attitudes, and behaviors are the focus of current research not only in organizational settings (Allen et al. 2005; Piderit 2000) but also in the IS context (Agarwal and Prasad 1999; Devaraj et al. 2008; Laumer et al. 2016; Maier et al. 2012; McElroy et al. 2007). However, to date, personality traits as antecedents of perpetual beliefs or moderators have only been sparsely considered in IS adoption or post-adoption models. Therefore, many scholars call for further research in this field (Devaraj et al. 2008; Maier 2012). In particular, Maier (2012) identifies RTC as a trait that has been mostly neglected by IS research despite promising new insights. Polites and Karahanna (2012) follow this notion in a first step by considering RTC as a

control variable for technology acceptance. Also, Nov and Ye (2008) and Maier et al. (2011) have examined RTC as an antecedent of perceived ease of use and usefulness of a system. These insights from organizational research suggest significant differences in reactions between more and less change-resistant individuals that are faced with change. Consequently, it appears relevant to examine the effects of this personality trait in post-adoption settings more thoroughly (Maier et al. 2012). As such, we focus our investigation on the role of dispositional RTC in relation to the changing nature of the IT artifact and its impact on users' beliefs, attitudes, and behaviors during system use through the lens of ECT.

7.3 Hypothesis Development

To develop our hypotheses and to isolate the underlying mechanism of how and why feature updates might influence users' beliefs and intentions, we assume three prerequisites. Firstly, we will elaborate on feature updates that affect the core functionality of software with respect to the software's main purpose by adding distinct, discernible features that are employed by the user in accomplishing a task or goal. Secondly, we study feature updates that manifest during usage and are thus noticed by the user and ignore updates that are silently implemented in the background. Thirdly, we focus on non-mandatory settings regarding CI (e.g., consumer software).

Oliver's (1980) ECT posits that for positive disconfirmation to occur, an *unexpected* and *positive* experience is necessary. This requires a surprising and relative improvement with respect to an individual's subjective reference point (the baseline for comparison) (Helson 1964). Referring to a feature update, it hence needs to induce a positive experience with the software relative to the previous state. Following research on RTC, it is reasonable to expect that users with a weak disposition to resist change are open to novelties like new features due to a weak desire to *seek routine* and will likely perceive the unexpected update in functionality positively and as a 'free gift' (Devaraj et al. 2008; Oreg 2003). Moreover, because of a stronger psychological resilience, their *emotional reaction* to a change in the software will be less stressful, which reinforces a positive perception of the update (Oreg 2003). Most importantly, as they are *less short-term focused*, they will more likely accept short-term inconveniences to learn and adjust to the enhanced software in the face of the long-term benefits (Maier et al. 2012; Polites and Karahanna 2012). Because such users are also less *cognitively rigid*, we assume that they

will change their beliefs about the software more easily instead of dwelling on their prevalent perception. Therefore, feature updates that require a small effort of reorientation but are designed to enhance the software constitute a positive experience (Larsen et al. 2009). Furthermore, software providers often do not announce updates beforehand, and if they do, consumers quite likely do not catch up on all of the details. Thus, we can reasonably assume that users perceive updates as *unexpected* events during usage. In sum, it is likely that less change-resistant users will perceive a feature update as an *unexpected* and *positive* experience during use, which, according to ECT, induces positive disconfirmation.

Following this reasoning, a software provider should be able to create positive disconfirmation and thus increase CI of users with a weak disposition to resist change by deferring the release of functionality from the first release into subsequent usage periods and then deliver this functionality through free feature updates. The design of such an agile software product can be distinguished from a feature-complete software package. To summarize, because of the subjective nature of the disconfirmation mechanism in ECT, openness to changes, emotional ease, acceptance of short term inconvenience and willingness to adjust to new situations, users with a weak disposition to resist change of software that receives functionality via feature updates will likely have a higher CI than users who received all these features right with the first release. We accordingly derive our first hypothesis:

H1: Software that receives features via incremental updates induces higher continuance intention to users with a weak disposition to resist change compared to software that includes all these features right with the first release.

We posit that the effect of updates on users with a strong disposition to resist change can also be explained through ECT, yet induces a different response to receiving feature updates. As implied by ECT, the positive effect of feature updates on users' CI involves (in addition to unexpectedness) a positive experience (Oliver 1980). Following research on RTC again, it is reasonable to assume that users with a strong disposition to resist change *seek routine*. As a result, due to a stronger need for a stable environment, they will not perceive unexpected feature updates as positive as less change-resistant users (Devaraj et al. 2008; Oreg 2003). Also, as users' *emotional reaction* to changes tends to be uneasiness, the positive experience triggered by feature updates compared to the

subjective reference point might be weakened by emotional expenses. Moreover, users with a strong disposition to resist change are *short-term focused*. Therefore, they will be less likely to invest as much in short-term inconveniences necessary to adjust to changes in the IT artifact to benefit from the enhanced software (Polites and Karahanna 2012). Since they are more *cognitively rigid*, we assume that they will more likely stick to their prevalent perception, hindering a positive experience to occur. Overall, it is thus likely that change-resistant users, albeit perceiving a feature update as *unexpected*, will not consider it as a *positive* experience during use; hence, the update will likely not induce positive disconfirmation and higher CI when software is delivered through feature updates compared to when all features are delivered right with the first release. We therefore hypothesize:

H2: Software that receives features via incremental updates does not induce higher continuance intention to users with a strong disposition to resist change compared to software that includes all these features right with the first release.

Following the reasoning above, we suggest that the effect of feature updates works through a positive disconfirmation of previous expectations regarding the software (Anderson and Sullivan 1993). In terms of the continuance model, disconfirmation should thus mediate the effect of feature updates on CI (Bhattacharjee 2001). This mechanism of positive disconfirmation that induces a higher CI requires a positive experience to occur. As reasoned in our first hypothesis, less change-resistant users will most likely perceive feature updates as a positive experience during software use compared to the software's pre-update state. In contrast, as outlined in hypothesis two, more change-resistant users will most likely not perceive a feature update as a positive experience because they tend to devalue changes (Oreg 2003). Hence, we assume that the update will not cause positive disconfirmation for more change-resistant users. Given these diverging responses to feature updates, the mediating effect of positive disconfirmation is moderated by a users' propensity to resist change. Summing up, we propose that higher levels of CI regarding software that receives functionality through feature updates compared to software that includes all features right with the first release will be the result of a mediation effect through positive disconfirmation that depends on users' RTC.

H3: Positive disconfirmation of previous expectations with the software will mediate the effect of incremental feature updates on users' continuance intentions contingent on the individual's disposition to resist change.

7.4 Method

7.4.1 Experimental Design

Following previous online experimental research (Klumpe et al. 2018; Koch and Benlian 2017; Schneider et al. 2019), we conducted a scenario-based (also known as vignette-based) 2x2 between subject online experiment with manipulations of software delivery design (feature-complete vs. software update) and users' RTC (low vs. high). In doing so, we examined and isolated the effect of feature updates on users' CI contingent on user's dispositional RTC, as suggested by our hypotheses (see Figure 29). Groups A and C were exposed to all features right with the first release and received no updates (feature-complete). In contrast, groups B and D received only 1 feature right with the first release and received all remaining features through a feature update during the usage phase (software update). Moreover, we manipulated the degree of RTC between the groups (i.e., low RTC in groups A and B vs. high RTC in groups C and D). The subjects were randomly assigned to one of the four groups, and the software, as well as the task for which the software had to be used, were deliberately held constant across all conditions.

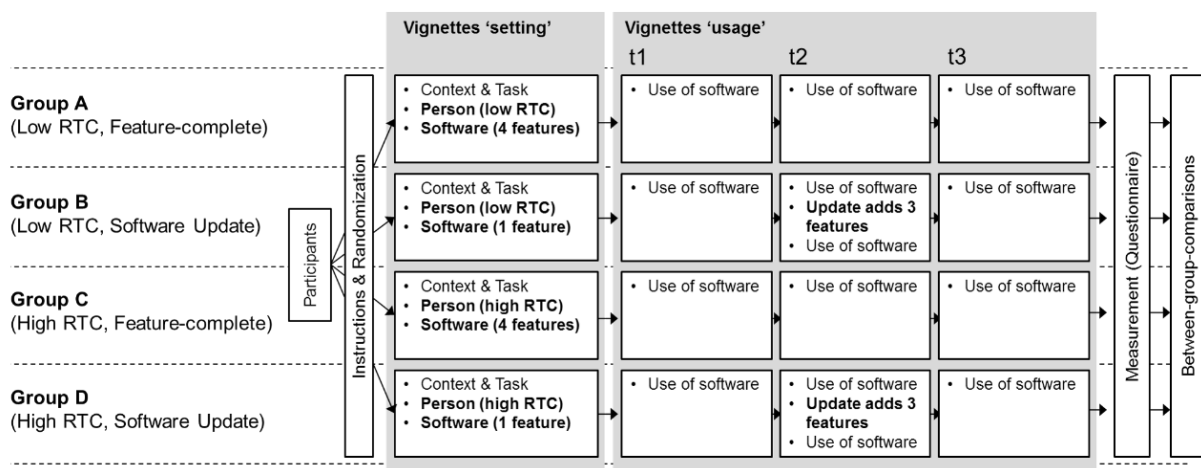


Figure 29: Experimental setup.

We implemented the manipulations of feature updates and dispositional RTC by presenting participants with carefully constructed textual scenarios (i.e., vignettes) that precisely described a fictitious person (user), task and software (vignette 'setting'); the

software's usage at three points in time and a conditional update (vignettes 'usage'). We used the experimental vignette methodology (EVM) (Aguinis and Bradley 2014), which is widely used in IS research (Dennis et al. 2012; Vance et al. 2013; Vance et al. 2015), to manipulate the protagonist's dispositional RTC and avoid social desirability bias (Auspurg and Hinz 2015; Bhal and Dadhich 2011). The EVM allowed us to precisely manipulate the acting character's disposition to resist change in an isolated manner by being able to completely control the setting and reduce contaminations from possibly related other individual differences that often occur jointly (Bhal and Dadhich 2011). Similar to lab experiments, vignette methodology comes with downsides such as artificial simplifications and hypothetical linear usage scenarios; however, it enables precisely employing manipulations, accurately examining the effects on dependent variables, and identifying hypothesized causal relationships (Aguinis and Bradley 2014). Hence, we preferred this approach to other potential methods. Scholars in IS research, and other disciplines (Benlian et al. 2019; Lowry et al. 2017; Warkentin et al. 2017) have repeatedly shown that individuals respond similarly whether they are presented with a hypothetical situation using vignettes or a traditional laboratory experiment.

Consistent with previous experimental studies (e.g., Adam et al. 2020; Röthke et al. 2020), the experiment proceeded in multiple consecutive steps. First, subjects were welcomed, told to answer questions to the best of their knowledge, and were then randomly assigned to one of the four experimental groups (see Figure 29). Second, subjects were instructed to carefully read the vignettes and put themselves in the hypothetical setting described in the scenario and take the protagonist's perspective. Then, they were presented with the corresponding first vignette ('setting'). The vignette introduced a fictitious character and described a travel booking task (context & task), the character's weak or strong disposition to resist change (person), and a travel booking platform (TBP), including its initial feature set depending on the experimental condition (software). Third, on the next three pages (vignettes 'usage'), subjects were presented with three vignettes that described the software usage at one of three time periods (t1, t2, and t3). Each of the three vignettes first described the (re-)visit of the TBP, the currently available feature set, and then described how the person in the scenario uses the TBP to accomplish the task. The three periods (consecutive weekends) were used to simulate a routine use of the software. In the period t2 (half-time of the total usage period), the availability of new functionality through an update was described (not

applicable to the feature-complete software conditions). After the update, this vignette ended with further TBP usage as in the other periods, now including the new features. Subsequently, after the three usage periods, a post-experimental survey asked subjects to respond to questions measuring their evaluation of the CI of the person described in the scenario and all further variables (see Measures).

7.4.2 Manipulation of Independent Variables

We used a travel booking scenario as a context for our manipulations because such scenarios were frequently reported in our pretest to be common settings in which features are updated on a regular basis. In so doing, we followed recommendations in the methodological literature that suggest improving realism in the stimulus presentation by increasing the level of immersion and similarity between the experimental and natural settings (Aguinis and Bradley 2014). Moreover, by choosing an online service, we could separate the effects of receiving feature updates from interfering factors like performance or technical issues that might occur on some platforms (Sykes 2011; Tyre and Orlikowski 1994).

The specific task was booking a vacation with a limited monetary budget and further constraints that fostered the use of the individual features on the TBP. To construct the different stimuli, we identified 22 features that were perceived as useful for the task but left the TBP fully functional when absent. As part of a pre-study ($n=20$), we had evaluated these 22 features in terms of their perceived importance for travel booking. Four features with similar levels of importance were identified as appropriate to establish the update and baseline stimuli: *calendar functionality to plan the stay*; *user ratings of accommodations with stars*; *professional holiday reviews*; *a budget calculator to find and plan fixed budget vacations*. Groups A and C had all four features right from the beginning, groups B and D had only the *calendar functionality to plan the stay at the beginning* and the remaining three features were added through an update in t2.

To operationalize the manipulation, we constructed textual vignettes and presented them to participants over several consecutive pages. On the first page, we briefly introduced the student Max and his task. His task was planning a vacation to Madrid, Spain, over the next three weekends, for a time period after he finished his exams, with a price limit of 800 euros and a good accommodation quality. Second, we described Max's personality. Therefore, we followed the detailed specifications and validated item

wordings of RTC developed in previous studies (e.g., Oreg 2003; Polites and Karahanna 2012). For a strong (weak) disposition to resist change we described Max in the vignette as a person *'who considers change to be a negative (positive) thing,' 'who feels stressed (comfortable) when there is a significant change in the way a website is used' 'who tends to resist (engage in) changes even if (because) he knows that they will be good for him in the long run' and 'who does not (does) change his mind easily'*. Third, the software and its baseline feature(s) were described as follows: *'To find a suitable flight and hotel, in the following three weeks, he [Max] uses the TBP Journey4You. In addition to the simple search for flights and hotels, the platform offers the following functionalities: ...'* followed by the aforementioned features. On the following three pages, we first described Max's repeated visits of the TBP to find a suitable flight and hotel. On each of these pages, we indicated the current feature set. In the update period (not applicable to the feature-complete software conditions) we included a section that introduced the update *'Update, new functionality available: ...'* followed by a list of the three new features. After this conditional section characterizing the update, a description of further usage followed, conditionally including the use of the new features (see Figure 29): *'After a short interruption for reorienting on the web page, Max searches for flights and hotels. He proceeds with the website as usual but additionally uses the new functionality: ...'* followed by a description of the new features. Except for the manipulated text passages, all other parts of the scenario were kept constant across groups.

Following common vignette procedures (Aguinis and Bradley 2014), we ensured that our vignettes illustrated realistic situations and that participants identified well with the character described by conducting several revision cycles based on qualitative interviews between researchers. Furthermore, the designed vignettes were tested in another pilot study (n=51) to ensure that our treatments worked as intended (Perdue and Summers 1986). Our pilot study sample consisted mainly of students from different disciplines recruited from two universities in Germany. Specifically, our subjects were asked about the comprehensiveness of the instructions, the vignettes' realism and their ability to put themselves in the situation described in the hypothetical scenario, as well as the clarity of questions in the subsequent questionnaire. To collect the data, we used questionnaires with feedback fields and established scales. Moreover, in a separate pretest (n=26), we confirmed the successful manipulation of RTC (high vs. low) by finding a significant

difference in reported values for all facets of the protagonist's RTC while finding no difference in reported values of the subject's own RTC measured with the scales developed by Oreg (2003). Thus, we are confident that the manipulation worked as intended, and that participants could distinguish between themselves and the protagonist.

7.4.3 Measured Variables, Control Variables, and Manipulation Checks

We used validated scales to measure our variables with slight wording changes to adapt the items to our experimental setting. All items were measured on a seven-point Likert-type scale, ranging from 1 (strongly disagree) to 7 (strongly agree). Consistent with previous studies (e.g., Benlian et al. 2010; Goldbach et al. 2018), we adapted our measures for CI and disconfirmation from Bhattacharjee (2001). Our experiment also included items for satisfaction and perceived usefulness. However, since our substantial findings remained unaffected by entering these mediators in the nomological network, consistent with previous studies (e.g., Croitor and Benlian 2019), we excluded them from our main analysis to reduce the complexity of our research model. Both mediators have been repeatedly confirmed and are fully captured by CI (e.g., Fleischmann et al. 2016; Limayem et al. 2007). To ensure successful manipulations and to avoid possible covariates, we adopted widespread control variables and demographics (age, gender, education, profession) from the scenario literature (e.g., Fleischmann et al. 2016; Wallbach and Haag 2018). In detail, we asked our participants for their common usage of TBPs, to what extent they had understood *the items' formulation, the instructions*, to what extent they were *able to put themselves in the situation of the hypothetical scenario*, if *the hypothetical scenario was realistic*, and if they knew *what the goals of this survey were*. Moreover, we capture the participants' expertise regarding travel booking platforms on a scale by Mishra et al. (1993).

7.4.4 Participants, Incentives, and Procedures

We conducted our online experiment in Germany. The German questionnaire was translated (and back-translated) from the original English version by a professional translation services firm (Brislin 1970). Instead of using a student sample, we recruited participants over a crowd working platform, which completed the focal study in exchange for a small payment. Overall, 174 subjects started the experiment. The rate of completion was 90 % (i.e., a total number of 156 subjects completed the questionnaire).

Seven participants were excluded from our final analysis because they either did not pass attention checks or completed the experiment in less than 4.5 minutes (avg. was 8.5 minutes). Of the 149 remaining participants used in the following analyses, 68 were females, and 81 were males. The subjects' average age was 35.11 ($\sigma=12.10$) years. On average, 57 % of the subjects used TBPs for less than one hour, 36 % one to four hours, and 7 % more than four hours per month. The average reported expertise with a TBP was 4.34 ($\sigma=1.60$) on a seven-point semantic differential scale. Forty-two percent of subjects were employees, 20 % students, 18 % self-employed, 5 % pupils, and the remainder indicated different employment statuses. The educational backgrounds of the participants were diverse, including medical science, law, education, computer science, psychology, history, economics, politics, etc.

7.5 Data Analysis and Results

7.5.1 Control Variables and Manipulation Check

To confirm successful randomization, based on the results of Fisher's exact tests, we first ensured that there was no significant difference across experimental conditions in terms of gender ($p>0.05$) and profession ($p>0.05$). Second, we searched for differences between groups regarding the further control variables. The results of a one-way MANOVA showed no significant differences between groups $\lambda = 0.85$, $F[27,401] = 0.88$, $p>0.05$. None of the control variables were significant: age ($F=0.41$, $df=3$, $p>0.05$), usage intensity ($F=1.64$, $df=3$, $p>0.05$), product expertise ($F=0.16$, $df=3$, $p>0.05$), scenario's realism ($F=1.01$, $df=3$, $p>0.05$), adoption of scenario ($F=1.46$, $df=3$, $p>0.05$), understanding of questions ($F=1.30$, $df=3$, $p>0.05$), of instructions ($F=1.04$, $df=3$, $p>0.05$), and knowing what the goals of the survey were ($F=0.40$, $df=3$, $p>0.05$). Hence, we conclude that subjects were distributed homogeneously across groups and that those variables did not confound the effects of our experimental manipulations. Third, we confirmed successful manipulations by performing a *t*-test finding a significant difference in terms of the reported levels for the protagonist's RTC between conditions ($t=10.644$, $df=147$, $p<0.01$) and by performing a Fisher's exact test finding a significant difference in terms of the reported software delivery design type between conditions ($p<0.01$). Thus, we are confident that our manipulation has indeed worked. As indicators for the external validity of our findings, we further reviewed participants' answers regarding the realism and adaption of the scenario. For both

measures, participants reported high levels on a seven-point-Likert-scale (realism $\bar{x}=5.85$; $\sigma=1.21$ and adaption $\bar{x}=5.78$; $\sigma=1.16$). It is, therefore, reasonable to assume that our manipulations worked as intended and that participants thought and acted like the fictitious character.

7.5.2 Measurement Validation and Hypotheses Testing

A confirmatory factor analysis (CFA) was conducted using SmartPLS 3 (Ringle et al. 2015) to test the instruments' convergent and discriminant validity (Levine 2005). All items loaded on the target factors and scored above the threshold of 0.7, indicating proper construct validity (Bartholomew et al. 2008; Cock and Campbell 1979). Only a single reverse coded item of CI falls close below this level (range of standardized factor loadings: 0.635-0.944) but still increases Cronbach's alpha and AVE values, and therefore, was not dropped. AVE values for each construct ranged from 0.624 to 0.732, exceeding the variance due to error (0.5). The constructs were also assessed for reliability using Cronbach's alpha. A value of at least 0.7 is suggested to indicate adequate reliability, which we could confirm for all constructs with values ranging from 0.723-0.818 (Nunnally 1994). Furthermore, the composite reliability of all constructs (0.833-0.888) exceeded 0.7, which is considered the minimum threshold (Hair et al. 2011). Thus, all constructs met the norms for convergent validity. For satisfactory discriminant validity, the square root of the construct's AVE should be greater than the variance shared between constructs (Fornell and Larcker 1981). Both square roots of AVE (CI 0.856, Disconfirmation 0.790) exceeded inter-construct correlation (0.559), suggesting discriminant validity. Hence, the constructs in our study are theoretically and empirically distinguishable.

In order to test hypotheses H1 and H2, we conducted a one-way ANOVA with planned contrast analyses using IBM SPSS Statistics 25. Therefore, we analyzed CI as a function of the four experimental groups finding a significant difference between groups ($F=5.524$, $p<0.001$). The contrast analysis revealed that less change-resistant users showed a significant higher CI in the software update condition compared to the feature-complete condition ($\bar{x}'s = 6.35$ vs. 5.44 , $p<0.01$). This supports our hypothesis H1. More change-resistant users, on the other hand, exhibited no significant difference in CI in the software update condition compared to the feature-complete condition ($\bar{x}'s = 5.72$ vs. 6.04 , $p>0.1$), supporting our hypothesis H2. Table 13 provides an overview of the effects

of different conditions regarding RTC and software delivery design on CI. Figure 30 visualizes the different user reactions to feature updates indicating mean values of CI for users with strong and weak disposition to resist change across groups.

	I. Feature-complete	II. Software Update	II-I (Contrast)
Low RTC	A: 5.44 (1.12), n=36	B: 6.35 (0.82), n=35	0.91***
High RTC	C: 6.04 (1.00), n=37	D: 5.72 (1.09), n=41	-0.32
Note: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$ (one-sided); ANOVA-tests with contrast analyses			

Table 13: Means, mean differences, and significance levels of CI for groups.

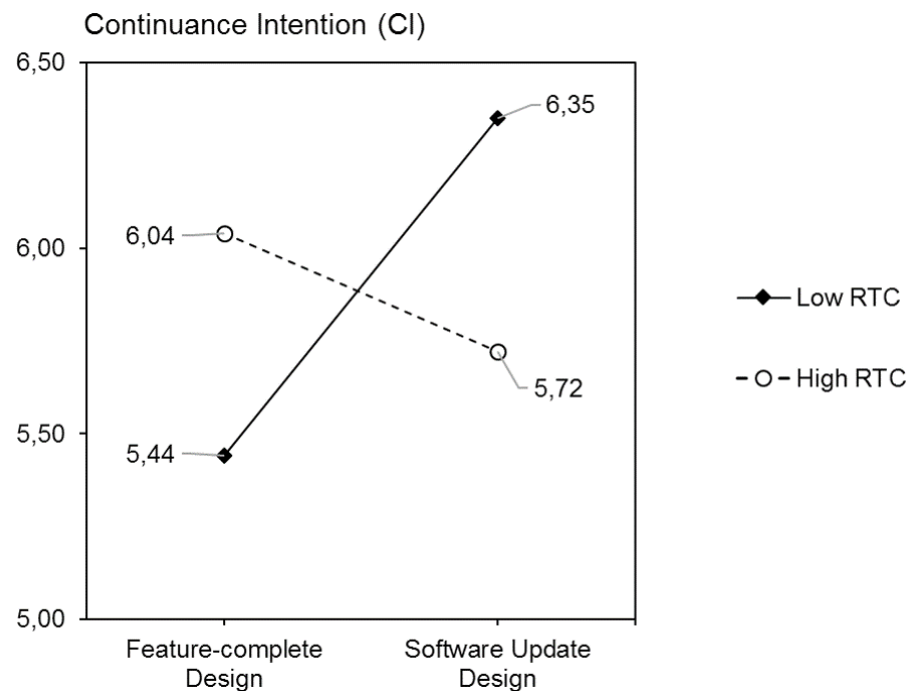


Figure 30: Responses of users with low or high RTC to updates.

In order to investigate hypothesis H3 and to explore the psychological mechanism behind the different responses to feature updates, a moderated mediation analysis of the continuance model's core variables Disconfirmation and CI was performed. Because we need a more complex analysis to attempt to understand the mechanism at work while simultaneously allowing these effects to be contingent on individual differences, we used PROCESS (Hayes 2013) for conditional process modeling. Figure 31 provides an overview of the analyzed model with direct and indirect paths, as well as the moderator's direct and interaction effects.

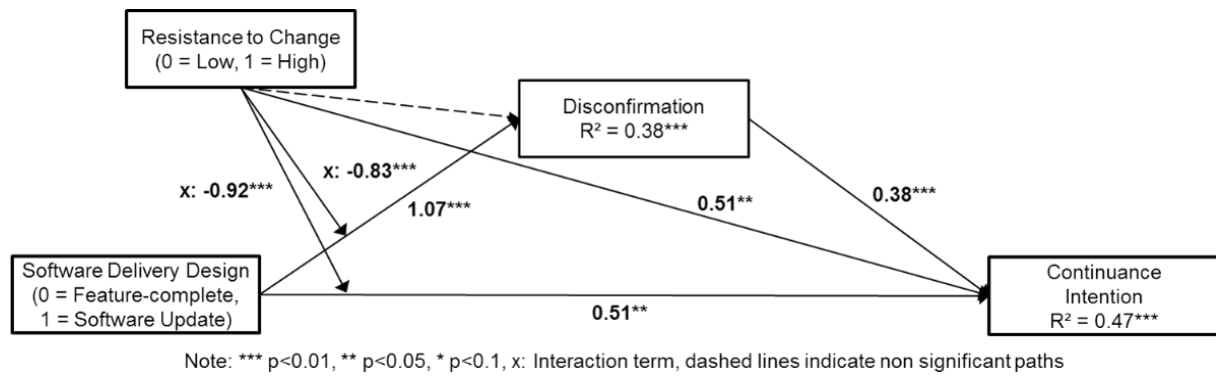


Figure 31: Overview of the analyzed model with direct and indirect paths.

The results from a bootstrapping analysis reveal that feature updates significantly increase positive disconfirmation ($\beta = 1.07$, $p < 0.01$), which in turn increases CI ($\beta = 0.38$, $p < 0.01$). However, the direct effect of feature updates on users' CI ($\beta = 0.51$, $p < 0.01$) remains significant after including disconfirmation, suggesting only a partial mediation (Hayes 2013). Furthermore, the effect of feature updates on disconfirmation is contingent on RTC, as evidenced by the statistically significant interaction between RTC and disconfirmation ($\beta = -0.83$, $p < 0.01$). Likewise, the direct effect of feature updates on RTC ($\beta = -0.92$, $p < 0.01$) and the direct effect of RTC on CI ($\beta = 0.51$, $p < 0.05$) are contingent.

	RTC	Coefficient	SE	t-value	p-value	LLCI	ULCI
Dir.	Low	0.5078	0.2420	2.0987	0.0376	0.0295	0.9861
	High	-0.4113	0.2158	-1.9062	0.0586	-0.8378	0.0152
Ind.	Low	0.4094	0.1262	-	-	0.2088	0.7075
	High	0.0907	0.0938	-	-	-0.0745	0.2953

Table 14: Direct and indirect effect of updates on CI contingent on RTC.

Inspecting the bootstrapped confidence intervals of the conditional direct and indirect effects in Table 14 (1,000 samples, 95 % bias-corrected confidence intervals, LLCI & ULCI), reveals that only treatments with a low moderator (weak disposition to resist change) were significant. In contrast, for high values of the moderator, the direct and indirect effects of updates on CI were not significant. As a result of the alternating significant contingent paths, as suggested by our hypothesis H3, we can conclude a moderated mediation of the effect of feature updates on CI through disconfirmation with RTC acting as a moderator.

7.6 Discussion

This study sought to answer the question of how and why feature updates influence users' CI differently, contingent on their dispositions to resist change. To achieve these objectives, we drew on the IS continuance model and literature on RTC to investigate our hypotheses using a vignette-based online experiment with 149 participants, which allowed us to enhance the internal validity of our findings.

Our results reveal that users with a strong disposition to resist change show divergent reactions to feature updates. In the case of less change-resistant users, a feature update led to an increase in CI. At first glance, this response seems to be conventional wisdom, as the software's value increases by such a functionality enhancing change in the IT artifact. However, when considered in more depth, the result is somewhat surprising and counter-intuitive. Users in this software update treatment (group B) had an objective disadvantage compared to users in the feature-complete treatment (group A): over the presented total usage period, those users had in sum fewer features to accomplish their task because they received them incrementally compared to those users who had all these features right from the beginning. Despite this objective disadvantage, participants in group B showed a significantly higher CI, which demonstrates a relative and malleable perception of a software's delivered value. More change-resistant users, on the other hand, showed a different reaction. Their CI was not significantly different in the update condition from in the non-update condition. Such users receiving feature updates, despite also being objectively disadvantaged compared to users that had all features right from the start, did not show a significant difference in CI. Still being somewhat counter-intuitive, this may be explained by a high RTC, which diminishes the effect of feature updates as observed with less change-resistant users. Both results challenge the idea of a rational user in the IS literature (Bhattacharjee and Barfar 2011; Ortiz de Guinea and Webster 2013), who maximizes the total benefit and should, therefore, prefer the availability of all features from the beginning. This becomes evident because neither high (preferred feature updates) nor less (are indifferent) change-resistant users preferred the feature-complete treatment.

We could also show a partial mediation of the positive response to feature updates regarding CI by ECT's core variable 'disconfirmation' for less change-resistant users. Due to the unexpected and positive surprise caused by the additional functionality provided

by the update, subjects seemed to experience a positive disconfirmation of previous expectations. More change-resistant users, however, probably due to a lack of positive perception, did not show this response. In contrast, in this group, feature updates appear to have only a marginally significant direct effect on CI and no indirect effect through disconfirmation on CI. Finally, we revealed a positive direct effect of RTC on CI. This observation may be explained by the theory about RTC, which suggests that more change-resistant users will not update their beliefs, attitudes, or change their behaviors easily.

7.6.1 Implications for Research

We contribute to IS research in three important ways. First, this study contributes to the body of knowledge in personality traits research (Maier et al. 2019; Pflügner et al. 2019; Thatcher et al. 2018) by showing that reactions to feature updates are different between users with weak versus strong dispositions to resist change. Specifically, more change-resistant users do not show a significant positive response to features that are received from an update compared to situations in which they have the entire feature set from the beginning. In contrast, less change-resistant users that receive features through an update show a positive reaction in terms of CI. This reaction has a more positive impact on CI compared to situations in which the entire feature-set is provided at once with the first release. These diverging findings for different types of users emphasize the importance of joint consideration of a changing IT artifact and users' individual differences when investigating their CI (Burton-Jones and Straub 2006; Hong et al. 2015). Second, this work complements previous knowledge on the mechanism behind different responses to updates (Fleischmann et al. 2016) by investigating the role of disconfirmation with previous expectations as a mediator, while simultaneously considering RTC as moderator for the effect of feature updates on users' CI. Specifically, we find that the positive effect of feature updates on CI is partially mediated by a positive disconfirmation of previous expectations regarding the software due to the update. This finding is contingent on individuals' dispositional RTC. Thus, RTC seems to moderate the positive effect of receiving features through updates and its mediation by disconfirmation. In this way, we identify RTC as a boundary condition for the effect of updates on CI. Third and lastly, our study extends the body of knowledge in IS post-adoption research (Kim and Son 2009; Li and Liu 2014) by showing how a malleable IS might influence users' attitudes and behaviors during use. This contribution answer calls

of several IS researchers by extending the predominant view of post-adoption literature on the IT artifact as a static, monolithic block to a more malleable and dynamic perspective (Benbasat and Barki 2007; Benlian 2015a; Jasperson et al. 2005). We consider IS as a modular composition of features that may change over time, and we thereby complement existing IS post-adoption literature through contributing the notion that users' beliefs and attitudes might fluctuate over time depending on individuals' differences and changes in the IT artifact.

7.6.2 Implications for Practice

Studying the role of users' RTC and the effects of updates in post-adoption settings has important practical implications. Our findings suggest that regardless of users' resistance to change, it is an advisable strategy for software providers to defer software functionality and distribute it later via updates instead of delivering all features right with the first release. For those users that are less change-resistant, feature updates can increase users' CI in a way that greatly exceeds CI of a feature-complete software. In contrast, users that are more change-resistant will not be affected by the same strategy and will keep CI on a similar level. However, software providers should not unnecessarily delay the delivery of feature updates, because customers will easily evaluate the features available with similar products, which can prohibit adoption before the provider is able to gain or retain customers.

7.6.3 Limitations and Future Research

Our study has three noteworthy limitations that provide avenues for further research. First, we employed textual vignettes to realize the manipulations in our experiment. Although being a widely established methodology in experimental research, vignettes have some notable limitations (Aguinis and Bradley 2014). Most of all, subjects are required to put themselves in the situation of the scenario. However, we asked participants how successful they were in this regard and about the perceived realism of the scenario. Based on the results regarding these measures, we are confident that our vignettes worked as intended, and our study's implications are applicable to real usage settings. Nonetheless, future studies should investigate actual usage experiences with real software to validate our findings. Second, we identified users' RTC as a crucial moderator for the effect of updates on users' CI and manipulated the protagonist's characteristics of this trait through the scenario to isolate possible core effects from other

confounding factors. Although other studies have already manipulated personality traits in vignette studies (e.g., Bhal and Dadhich 2011) and a successful pre-test indicated a valid manipulation of RTC, future studies should measure this trait in real-world scenarios and are encouraged to explore additional user characteristics. Third, to obtain results with high internal validity, we designed a controlled experiment. For this reason, we had to make reasonable but specific assumptions, such as a linear course of events and ex-post measurement of variables. Future studies should complement our findings by conducting longitudinal field study and using repeated measurements to advance the external validity of our findings. Fourth, regarding our assumptions about feature updates, we acknowledge that in practice, there might be cases, where feature updates are perceived negatively by users. If, for example, features are intentionally removed (e.g., due to expired license agreements), this can cause a negative disconfirmation. Thus, further research should build on our results and investigate the moderating influence of RTC on negative confirmations.

8 Conclusion and Contributions

This thesis aimed to identify factors and their consequences that prevent or slow down the assimilation and diffusion of MSPs in dynamic B2B networks. Previous research on the assimilation and diffusion of MSPs had predominantly used a pro-innovative perspective so that factors that led to the collapse of MSPs have so far been overlooked. To illuminate this research gap, two research questions were raised in this thesis. Two studies were conducted in order to answer the first research question, “*What are the key inhibiting factors of MSP diffusion in dynamic B2B networks, and how do they influence the diffusion process?*”. The first study based on a grounded theory approach and identified 21 factors inhibiting the intra-organizational MSP assimilation process in dynamic B2B networks. The second study examines the inhibiting effect of these 21 factors on network effects, which are a key driver of MSP diffusion. The results of this study indicate that 16 of the 21 factors slow down or even thwart positive network effects and thus strongly influence the diffusion of MSPs in dynamic B2B networks.

In order to examine the second overarching research question, “*To what extent do these inhibiting factors influence individuals’ pre- and post-adoption behavior?*” three additional studies were carried out. Each of these studies examined the effect of a specific factor on individuals’ pre- or post-adoption behavior. The third study deals with the influence of the inhibiting factor *functionalities* and examines to what extent specific features of the blockchain technology (i.e., immutability and traceability of information as well as an anonymous use of the technology) influence trust in technology. There is consensus in the IS community that trust in technology constitutes an essential and influential determinant of individuals’ pre-adoption behavior. The results demonstrate quantitatively that these specific features of the technology can independently stimulate trust in technology and, consequently, individuals’ adoption behavior as well. The fourth article examines the effect of the inhibiting factor *blaming other actors*, which scientifically corresponds to a causal attribution, on individuals’ continuance intention behavior. Based on a scenario-based online experiment, the study revealed that internal attribution of blame (self-attributed) for information overload is associated with a higher continuance intention than external attribution (attributed to the information system). Thus, when users in an organization attribute external reasons to a negative or undesirable outcome of an IS, the lower continuance intention can lead to an

assimilation gap and slow down or even stop the assimilation of the IS in that organization. The fifth study examined the influence of the factor *spirit of innovation*, operationalized by the personality trait resistance to change, on users' post-adoption behavior. The results of the scenario-based online experiment indicate a positive effect of feature updates (subsequent feature extension of software through an update) on the continuance intentions of less change resistant-users. Surprisingly, this effect disappears for more change-resistant users, which will not be affected by this strategy, and their continuance intentions will keep on a similarly high level. In light of MSP diffusion, this suggests that continuous functional enhancements of the platform should be offered. On the one hand, this strategy allows the continuance intention of users with a high resistance to change to be maintained at an unchanged high level. On the other hand, the continuous functional enhancements create new stimuli for users with a low resistance to change, so that their intention to continue using the platform is increased. This in turn reduces the risk of a possible assimilation gap and thus promotes the diffusion of the platform.

8.1 Theoretical Contributions

Overall, the thesis provides a deeper and more detailed understanding of the diffusion of MSPs in dynamic B2B networks. The five studies included in this thesis have been conducted in order to identify the core inhibiting factors of MSP diffusion as well as their influences on individuals' pre- or post-adoption behavior on the intra-organizational assimilation process, and on main drivers of MSP diffusion (i.e., on network effects). All five studies contribute to answering the two overarching research questions, and examine the influences on MSP diffusion from different angles.

First of all, heeding calls for research from de Reuver et al. (2018), Kembro et al. (2017) and Benlian et al. (2018), this thesis is one of the first to systematically and comprehensively investigate factors inhibiting MSP diffusion in dynamic B2B networks. Previous research has predominantly used a pro-innovative perspective and focused on the bright side of platforms. By doing so, scholars have investigated diffusion-promoting factors mostly in B2C and occasionally in low or semi-dynamic B2B networks (Kembro et al. 2017). However, essential aspects of the dark side of MSP diffusion, including core inhibiting factors, have only been treated superficially so far. Van Alstyne et al. (2016), for example, analyzed "6 Reasons for Platform Fail" and showed that failures such as

"failure to share the surplus" or "failure to launch the right side" cause platforms to collapse. Besides that, the complex interrelationships between multiple stakeholders interacting in dynamic B2B networks have still not been addressed in the literature. Thus, this thesis extends the scarce literature on MSP diffusion by discovering 21 core inhibiting factors, which specifically stem from inter-organizational competition. Beyond detecting unique and consequential inhibitors in dynamic B2B networks, these findings add to existing research by allowing scholars to integrate the identified inhibitors into established diffusion theories and frameworks, such as network economics or more holistic, process-oriented theories such as the theory of the net-enabled innovation business cycle by Wheeler (2002). The extension of these theories by the revealed factors may substantially increase their explanatory and predictive validity. Furthermore, by focusing on the investigation of inhibitors, this study provides new stimuli to broaden the common pro-innovative perspectives of existing IS research in general and particularly of MSP research, and extend the prevalent theoretical lenses.

Second, the thesis contributes to the research at the interface between platform and technology diffusion research. Network effects are a key element of MSP diffusion and often determine the fate of MSPs. Previous research has only provided anecdotal evidence of the effects of inhibiting factors on network effects and has overlooked to examine their intricate interrelationships. This thesis sheds a nuanced light on the impact of inhibiting factors on same- and cross-side network effects in order to better understand which factors exactly influence which type of network effects. This knowledge enables scholars to design studies on network effects more precisely. For example, by identifying and categorizing inhibiting factors, scholars can manipulate factors influencing cross- or same-side network effects in an isolated or joint manner. In doing so, scholars can understand MSP diffusion on a deeper and more detailed level.

Third, by examining the effects of specific factors inhibiting MSP diffusion on individuals' pre- and post-adoption behavior, this thesis contributes to a more nuanced view on how these factors influence the diffusion process at different levels. A slowing down or even a stop of the organizational assimilation process can also cause a slowdown or stop of the diffusion process of an MSP. Similarly, scholars often mention individuals (undesirable) behavior as a reason for slowing down or stopping the assimilation process. Taking the example of three selected factors that inhibit MSP diffusion, this

thesis was able to show their influence on individuals' pre- and post-adoption behavior too. Thus, the influence of the inhibiting factors could be demonstrated at different levels, which contributes to a more nuanced view of the MSP diffusion process. Therefore, when investigating MSP diffusion, scholars should bear in mind that identified factors also show effects at various levels and may cause possible interactions at these levels.

8.2 Practical Contributions

Besides theoretical contributions, this study also provides fruitful contributions for several stakeholders along the MSP ecosystems. Through the granular identification of codes, factors, and overarching themes as well as the revelation of their impact on network effects, on the assimilation process, and on individuals' pre- and post-adoption behavior, practitioners along the MSP ecosystems will be able to develop interventions and countermeasures to mitigate the inhibitors of MSP diffusion in dynamic B2B networks at an early stage and for different levels. Furthermore, evaluating the relevance of the factors provides a prioritization of the inhibitory factors so that practitioners are now able to address influential inhibitory factors first. Apart from the overarching perspective, the thesis also offers tailored contributions to different stakeholders along the MSP ecosystems.

Firstly, for platform providers, this thesis contributes knowledge to increase the acceptance of platforms and enhances in-depth understanding of the development and growth of the platform ecosystem. In detail, particularly findings on factors belonging to the overarching theme "characteristics of the system provider" provide significant added value for this stakeholder group. Among others, the factors included in this overarching theme highlight the importance of the neutral behavior of the system provider. For instance, platform providers should not exploit their dominant role in the ecosystem and try to offer all complementary products themselves. Instead, they should provide open interfaces to allow complementors to offer complementary products or modules for the platform. On the one hand, this neutral and open behavior promotes the creation and growth of the platform ecosystem. On the other hand, it enables existing providers to connect their existing solutions to the platform. In this way, potential competition between platform providers and existing incumbent software vendors can be reduced, as

the incumbents' solutions can continue to be used, thus mostly maintaining their market shares and financial revenue streams.

Secondly, for vendors of additional platform modules or services, i.e., for complementors and platform providers, this thesis provides valuable insights as well. The results of this thesis have shown that technological features are able to influence trust in technology. Developers of components for the platform should, therefore, ensure that trust-building technical features are presented in such a way that they are perceivable for users. This trust-building instrument can positively influence the adoption of the modules or services. Furthermore, the results of the thesis also show that continuous function updates can increase the intention of users with a weak disposition to resist changes to continue using the system and keep it constant for users with a high inclination to resist changes. Complementors are therefore recommended to first release a lean version of their software and subsequently enhance it with function updates. By using this software strategy, the time to market of the software can be reduced, and complementors can react flexibly to changing requirements.

Thirdly, this thesis also provides significant contributions to organizations and users of MSPs in dynamic B2B networks. For organizations operating in these networks, it is valuable to understand underlying factors inhibiting MSP diffusion because the prevalent network structure where multiple stakeholders dynamically operate in an environment of frequently changing relationships requires great flexibility and easy and fast exchange of information with other organizations. MSPs offer enormous potential to tackle these challenges. However, they can only unfold their expected benefits if they have been fully assimilated within the organization. By revealing the impact of inhibiting factors on network effects, on the assimilation process as well as on individuals' pre- and post-adoption behavior, this thesis enables organizations to initiate specific countermeasures on various levels. By doing so, organizations are now able to steer the MSP assimilation in their organization more precisely, and thus network effects are strongly fueled, which accelerates the MSP diffusion process between organizations. Furthermore, the results of this thesis suggest that the attribution of external causes for a harmful or undesirable outcome of an IS (such as weak data exchange or the lack of the expected benefits from the system) can reduce the intention to continue using it. Consequently, users and organizations should try to identify internal reasons for the harmful or undesirable

outcome of the IS in addition to external causes. On the one hand, organizations and users can initiate immediate countermeasures for internal reasons of a harmful or undesirable outcome of the IS. On the other hand, an internal causal attribution increases the intention to continue using the system and thus foster its assimilation and diffusion.

8.3 Limitations and Future Research

This thesis offers broad avenues for further research but is also subject to some limitations. Even though the limitations underlying the five individual studies included have already been thoroughly outlined, two overarching limitations are noteworthy here, which, however, at the same time open room for new and additional research.

Firstly, to identify the inhibiting factors (Article 1) and to analyze their influence on network effects (Article 2), a qualitative approach was followed. While qualitative research approaches are particularly suitable for investigating an area that has not yet been thoroughly researched and for exploring new factors, these approaches are subject to limitations, such as limited statistical generalizability. The inhibiting factors and their influences on network effects were determined through the qualitative analysis of interview data. To strengthen their statistical generalizability, they should be confirmed in quantitative studies in the future. Nonetheless, already now, the revealed factors can serve as a starting point for further qualitative and quantitative studies of the diffusion of MSPs in highly competitive B2B networks.

Secondly, the studies included in the articles 3 to 5 each serve for the investigation of the influence of a particular factor on individuals' pre- and post-adoption behavior. To examine these influences, a scenario-based experiment was conducted in each study, in which the manipulations were carried out using a textual description and exemplary illustrations. Although the method used was appropriate for the contexts of the studies and the postulated hypotheses could be demonstrated empirically, some limitations of the scenario method should be explained in more detail. In these studies, the participants were asked to take the perspective of a fictitious person and to perform a task from that perspective. This procedure is often used in IS research (e.g., Lowry et al. 2013; Vance et al. 2013), but there may still be a difference between the real behavior of the participants and the given behavior in the role of the fictional person. During the studies, open feedback fields were recorded in which many participants wrote that the studies were considered very realistic. Furthermore, the questionnaires of the studies contained

control questions such as scenario realism, scenario understanding, and to what extent they could put themselves in the situation. Based on the consistently very positive results regarding these measures, it can be assumed that the scenarios worked as intended, and the study's implications are applicable to real usage settings. Nonetheless, future studies should validate the results in the field or apply further methodological approaches.

The opportunity for further progressive research does not only arise from the limitations of this thesis. The results of this thesis provide a fruitful soil for further research and can serve as a springboard for future studies. In this way, for instance, scholars can build on the results of this thesis and investigate influences of the revealed inhibiting factors at additional levels, such as on group or societal level, or investigate possible interactions between levels. Moreover, the results can serve as a stimulus to develop multi-level theories and to reconcile process- and variance-based theories by using multi-level research.

In conclusion, propelled by the rise of technology companies such as Facebook, Airbnb or Uber, multi-sided platforms have become increasingly important in a wide range of industries in recent years. Although previous research on MSPs have provided many valuable insights, particularly to factors that promote the success of multi-sided platforms, there are still large gaps on the research map. The investigation, for instance, of factors inhibiting the diffusion and their effects on network effects as well as on individuals' pre- and post-adoption behavior, has been overlooked so far. Moreover, in practice, MSPs often fail in dynamic B2B networks, and existing technology diffusion and adoption models can only provide anecdotal evidence of these failures. This thesis presents the first step to extend the understanding of assimilation and diffusion of MSPs in dynamic B2B networks. In five different studies, inhibiting factors could be identified, and their influences on diffusion-promoting forces (i.e., network effects) and individuals' pre- and post-adoption behavior could be delayed. The results of the thesis emphasize that to explain the diffusion of MSPs in dynamic B2B networks, an integrated, fine-grained view is required, which includes human, organizational, and inter-organizational aspects in addition to technical ones. This knowledge enables organizations to capture the full potential of MSPs, as they are now able to initiate tailored countermeasures at different layers and thus can steer the diffusion process of MSPs more precisely. Following this thought, it is desired that this substantial change of

perspective, as well as the systematic and comprehensive exposure of inhibitory factors, will encourage further research by other IS scientists.

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